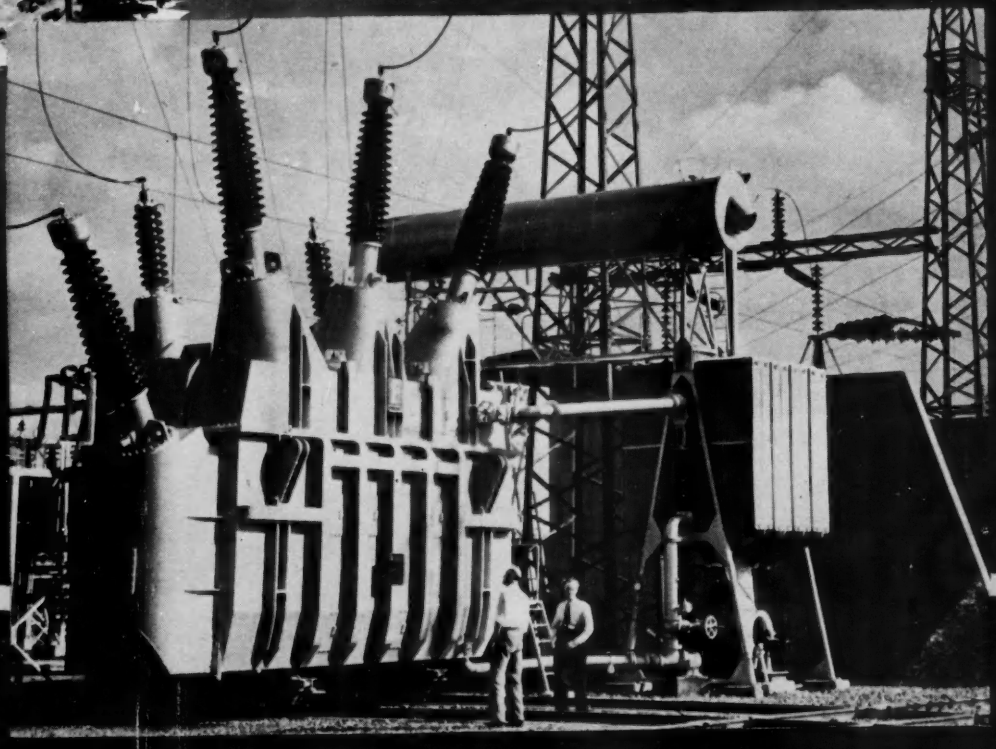
ELECTRICAL TIMES

5 now in commission

230,000 VOLT FERRANTI TRANSFORMERS IN FINLAND

(Above): The Pyhäkoski Power Station, total output 108 MW, the largest in Finland.

(Right): One of the completed transformers in the process of a Pyhäkoski Power Station.



FERRANTI

FERRANTI LTD · HOLLINWOOD · LANCS · ENGLAND

London Office: KERN HOUSE, 36, KINGSWAY, W.C.2

COOPERS

FELT

- *Felt Polishing Bobs*
- *Felt for machinery installation*
- *Felt washers, gaskets, strips, channels, rings*
- *Felt soft as cotton wool or hard as wood*
- *Coopers Felt serves the industry in many ways*
- *Coopers will be happy to send you free literature*

PREPARED TO THE SPECIAL REQUIREMENTS OF THE ELECTRICAL INDUSTRY

Please send enquiries to Head Office & Works

COOPER & CO. (B'HAM) LTD.

BRYNMAWR, BRECONSHIRE

Telephone: Brynmawr 312 *Telegrams: Felting, Brynmawr* *Registered Office & Works: Little King Street, Birmingham*

INTERESTED IN EMERGENCY LIGHTING?

Send for these informative booklets

Nife - Neverfayle emergency lighting has several important advantages — advantages you should know about before installing an emergency system. Nife - Neverfayle emergency lighting units are:

DEPENDABLE:
Power is instantly available because Nife Steel-Alkaline Batteries do not deteriorate even during long periods of inactivity.

CONVENIENT:
Nife equipment is exceptionally compact and there is no need for a separate battery room.

ECONOMICAL:
Since the electrolyte and active materials in the batteries are of great stability, maintenance costs next to nothing.

NIFE - NEVERFAYLE

the emergency equipment with the steel-alkaline battery

N66 B

B

NIFE BATTERIES, REDDITCH, WORCESTERSHIRE

Please send me booklets giving detailed information of NIFE-NEVERFAYLE units for

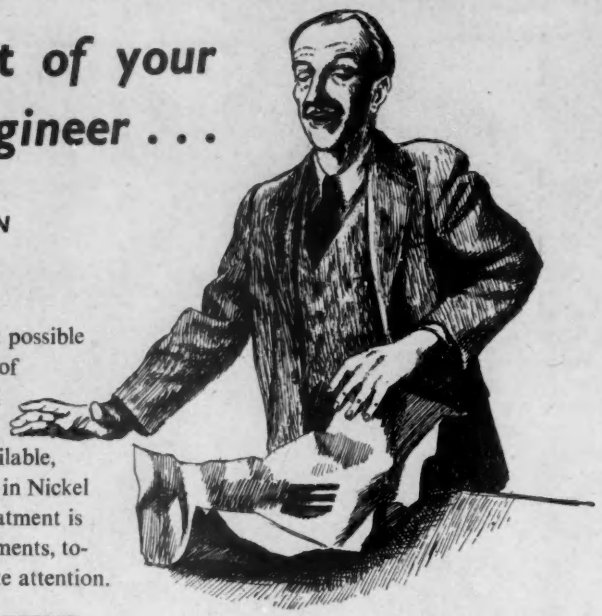
.....(CINEMA, HOSPITAL, PUBLIC BLDG, ETC.)

NAME .....

ADDRESS .....

A

To Gladden the Heart of your Development Engineer . . .



THE QUICK AND ACCURATE PRODUCTION OF PROTOTYPE LAMINATIONS

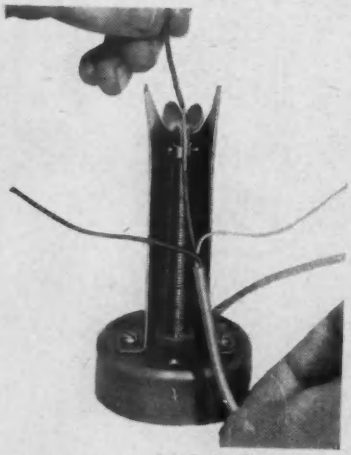
We supply prototypes for all new designs in the shortest possible time that size, type, and circumstances permit, in cases of emergency generally within a period of 7-28 days. Nickel Iron Alloy Laminations approximately 40 days. All metals and specifications in most cases immediately available, including High, Medium and Low Silicon Iron, and also in Nickel Iron Alloys. All Nickel Iron Alloy Lamination heat treatment is guaranteed. Send us a sample or sketch of your requirements, together with the specification, which will receive immediate attention.

ELECTRONIC EL LAMINATIONS

Telephone: Slough 25171-2 **LIMITED** *Telegrams: Lamination, Slough*

OXFORD AVENUE, SLOUGH, BUCKINGHAMSHIRE

DON'T NICK IT— *STRIP IT*



PRESERVE ALL YOUR CONDUCTORS

REMOVES P.V.C. & POLYTHENE INSULATION UP TO ⅜" DIAMETER QUICKLY & CLEANLY

READILY FIXED TO BENCH OR WALL

SUPPLIED FOR ALL VOLT RANGES

Reg. Design 871264

SOLE MANUFACTURERS & SUPPLIERS
PVC & POLYTHENE ELECTRIC CABLE STRIPPERS

ADCOLA (Regd. Trade Mark)

SOLDERING INSTRUMENTS & EQUIPMENT

ADCOLA PRODUCTS LTD.
GAUDEN ROAD
CLAPHAM HIGH STREET, S.W.4

Phone: MACAULAY 4272

HEAT PRESERVATION BY EETO

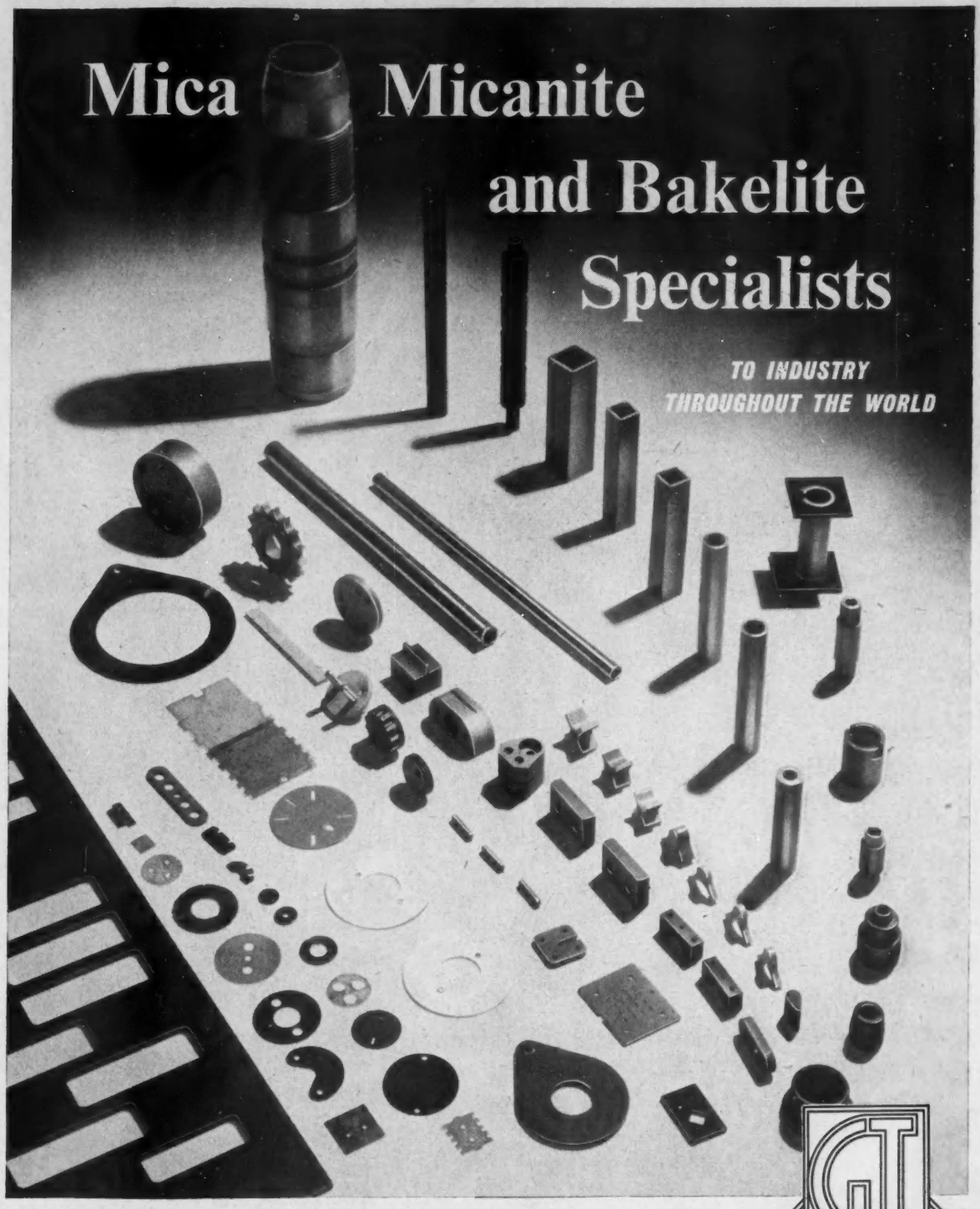
CYLINDER JACKETS

The ORIGINAL sectional Cylinder and Tank jacket, as used and recommended by almost every Municipal Undertaking in the Kingdom. There is no substitute.

EETO Service is prompt and efficient.

EETO INSULATIONS
River St., Bolton, Lancs.
Tel.: BOLTON 3764

C.W. 1907/143a



ALSO VARNISHED CLOTHS, TAPES AND SLEEVINGS. PRESSPAHN AND LEATHEROIDS. EBONITE AND FIBRE

GIBSON TODD & CO. LTD

ALBERT MILLS · RADCLIFFE · LANCASHIRE ENGLAND

Tel Radcliffe 2213/4. Grams: 'Micinsula' Radcliffe, Manchester

ON ADMIRALTY LISTS & A.I.D. APPROVED

ELECTRICAL INSULATION ENGINEERS AND MANUFACTURERS

A Big Cooker with a very Big Market

You can't beat a Belling 47AB! Continuous national and local advertising have made it the best-known electric cooker in the country. It has low maintenance costs, and has proved its efficiency and reliability over a period of many years. At £32.5.0 (including the inner glass door), the Forty Seven is just the thing for Hire Purchase schemes or cash sales.

- *Two boiling plates and grill-boiler*
- *Automatic oven control and Simmerstat*
- *Very large oven, with removable lining*
- *Large hotcupboard. Utensil drawer 24/- extra*
- *Exclusive full-size inner glass door*
- *Finished in white or cream vitreous enamel*

You can't beat a "Belling"

BELLING & COMPANY LIMITED. BRIDGE WORKS, ENFIELD, MIDDX. HOWARD 1212

DAVENSET

DEPENDABLE PRODUCTS

TRANSFORMERS · RECTIFIERS · CHARGERS · ETC.

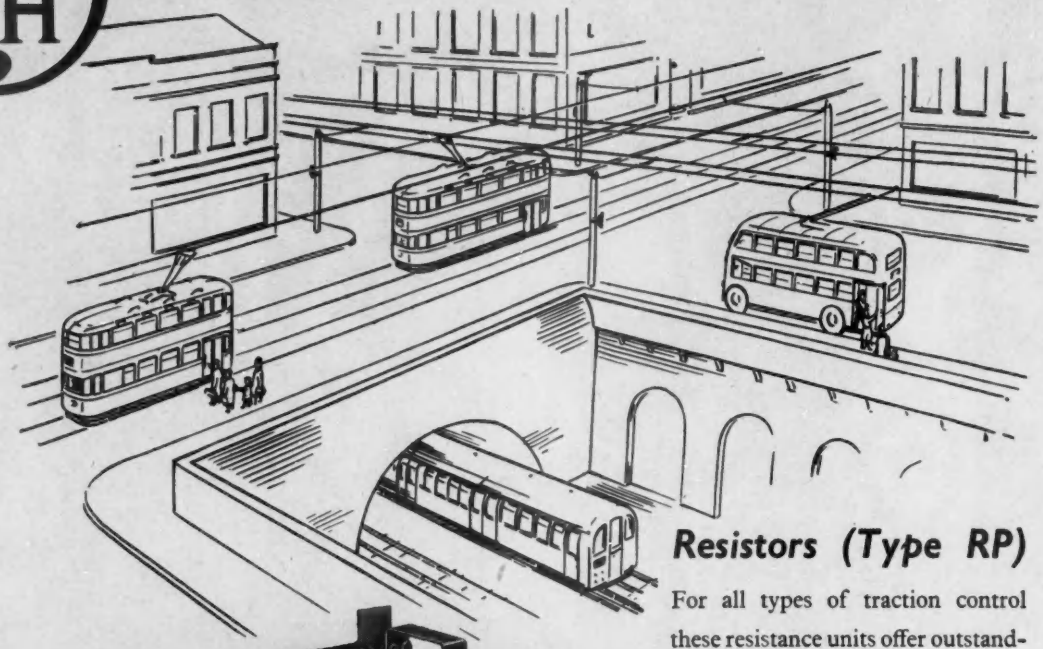
ELECTRICAL EQUIPMENT FOR EVERY REQUIREMENT

PARTRIDGE, WILSON & CO., LTD.

DAVENSET ELECTRICAL WORKS · LEICESTER

B T-H

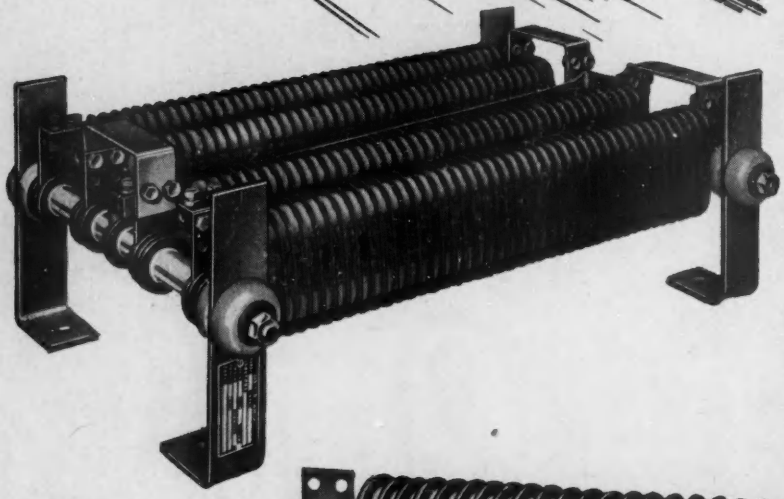
Electric Traction Equipment

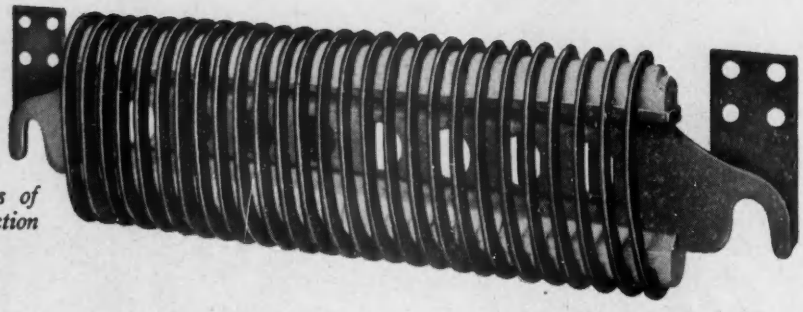


Resistors (Type RP)

For all types of traction control these resistance units offer outstanding advantages.

- Non - corrodible, chromium alloy steel.
- Edgewise-wound strip of liberal section and high specific resistance.
- Mounted on steatite spacers.
- Will withstand heavy overloads and high operating temperatures.





BTH manufacture all types of electric equipment for traction purposes.

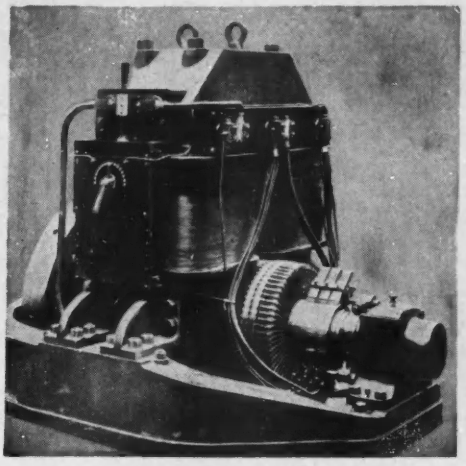
THE
BRITISH THOMSON-HOUSTON
COMPANY LIMITED, RUGBY, ENGLAND

Member of the AEI group of companies

A4410

SIXTY YEARS

60 years specialising in the manufacture of insulating varnishes and industrial finishes of all types.

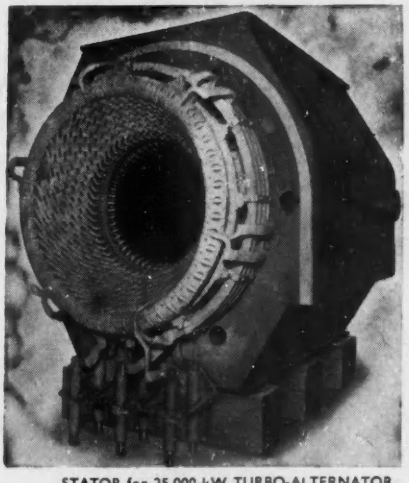


153-kW DYNAMO. Photo by courtesy of Laurence, Scott & Electromotors Ltd.

1894

MADE BY CHEMISTS - SERVICED BY ENGINEERS

1954



STATOR for 25,000-kW TURBO-ALTERNATOR. Photo by courtesy of The English Electric Co. Ltd.

We are proud of the fact that during this period our insulating varnishes have been supplied to the foremost electrical manufacturers throughout the world.

THE STERLING VARNISH CO. LTD.

FRASER ROAD, TRAFFORD PARK, MANCHESTER 17

Telephone: TRA 0282/3/4 *Telegrams:* "Dielectric, Manchester"

London Office and Warehouse: 6 London Road, Brentford, Middlesex. *Telephone:* EALing 9152

A542a

WANT TO SAVE TIME AND TOIL?
- SPECIFY THE "Duo-Coil"

THE "Duo-Coil" IMMERSION HEATER

Rigid and simple construction for long life.
Robust Temperature Control of unique design, which is a separate unit. The Micro Switch is removable for low replacement cost.
One element for 200/250 Volts, reducing stock problems.
Specially designed for hard water areas.
Attractive Prices.
Available in lengths from 10" to 35". Head sizes 1¼" or 2¼" B.S.P.
Full range of accessories at competitive prices.

Write for leaflet No. 117 for full details

PRICES FROM
£2.3.6 Plus P.T.

The only Immersion Heater which can be installed in this manner, due to the short thermostat and bendable element—simple bending jig available.
Simple; economical; bolt-on flange, which can be screwed to the Heater Head away from the tank.

MANUFACTURED BY:- GILLOTT ELECTRO APPLIANCES LIMITED
COTSWOLD WORKS, CHALFORD, Nr. STROUD, GLOS., ENGLAND
Telephone: Brimscombe 2276/7. *Grams: Elecsteam, Chalford*

Hillman ELECTRIC MOTORS
MULTIPLY PRODUCTION

Illustration F.H.4. with Reduction Gear.

Soundly constructed in top grade Materials and of first class workmanship.

IMMEDIATE DELIVERY of
UNIVERSAL MOTORS 1/100—1/6 h.p.
D.C. MOTORS 1/50—1/4 h.p.
THREE PHASE 1/50—1/10 h.p.
GEARED UNITS 0.25—900 r.p.m.
SINGLE PHASE, SPLIT PHASE & CAPACITOR MOTORS 1/50—1/20 h.p.
TORQUE UP TO 300 lbs/ins

We are also manufacturers of Domestic and Trade Sewing Machine Motors. Write NOW for details of our full range to Dept. E.22. Our Advisory Engineer is at your service.

Hillman ELECTRIC MOTORS LTD
2-3, NORTHWOLD BUILDINGS · NORTHWOLD ROAD · LONDON, N.16
Cables: HILLMANCO LONDON. Telephone: AMHerst 5274/5

No substitute for QUALITY

THE requirements of the electrical industry call for components of the highest quality. That is why CRESSALL Rheostats, Potentiometers, Resistor Units, etc., are designed and constructed to meet the most exacting conditions. Their quality is based on over forty years' experience of manufacture — a guarantee for long service and satisfaction. Whatever your requirement, there is a CRESSALL component to meet every need in the whole power range.

Registered trade name of
THE CRESSALL MANUFACTURING CO. LTD.
TOWER STREET · BIRMINGHAM 19
Telephone ASTon Cross 2666 (3 lines) *Telegrams "OHMIC, Birmingham"*

...MORE and MORE

LONDEX
TRADE MARK

RELAYS
for every purpose

Please write for DATA BOOK No. 144, which gives details of our very large range of relays and other automatic electrical control equipment, including:—

★ *Process Timers, Time Switches, Level Controls, Pressure operated Switches, Photo-electric Controls, Counters, Flow Indicators, Automatic Power factor Regulators.*

...and now our 4TH FACTORY
STARTS PRODUCING
. . to meet the INCREASING DEMAND
FOR LONDEX RELAYS AND TIMERS

LONDEX LTD ● ANERLEY WORKS LONDON S.E.20 ● TEL: ★SYDENHAM 6258

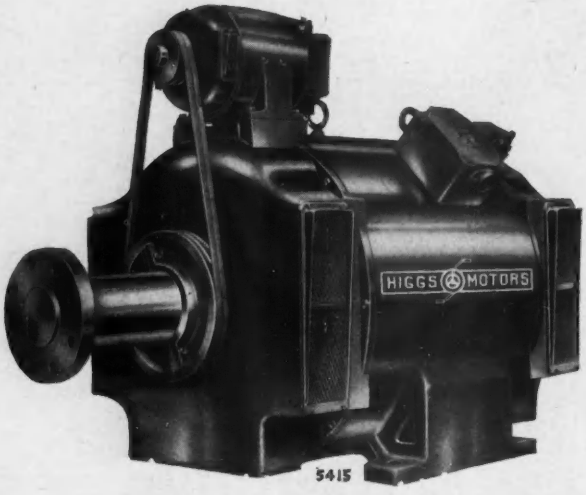
B

TRADE MARK

HIGGS MOTORS LTD.

CHAIRMAN WALTER F. HIGGS M.I.E.E.

BIRMINGHAM 6 ENGLAND



A.C. GENERATORS

One of the many types produced for both the Home and Overseas Markets at a competitive price and short delivery

GUARANTEED FOR EVER

Belfast, Bristol, Cardiff, Dundee, Glasgow, Hull, Leeds, Liverpool, London, Manchester, Newcastle, Peterborough, Sheffield, Wolverhampton

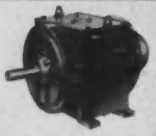
Make More of COPPER

Copper and its alloys are now available in ample supply for all purposes. Maximum economy and efficiency in the use of these versatile materials is achieved by careful selection and proper application. The Copper Development Association will gladly advise on any use of copper or its alloys—free of charge or obligation. The C.D.A. exists to help copper to help you and welcomes your enquiries.

FIRST ASK THE C.D.A.

COPPER DEVELOPMENT ASSOCIATION · KENDALS HALL · RADLETT · HERTS · RADLETT 5616

Compared with the orthodox alternator with overhung exciter

In	price	weight	volume	c.i.f.charges
the	BRUSH		Square	Path
Alternator	saves	you	about	20%

Highly efficient, easily maintained, in an output range from 1½ to 35 kVA, Brush Square Path Alternators are fully described in Publication No. 21043/B40. Send for your copy now!

SQUARE PATH alternators by BRUSH

BRUSH ELECTRICAL ENGINEERING COMPANY LIMITED, HOPKINSON WORKS, CARDIFF, GT. BRITAIN

Advisory Engineers are available at our Sales Offices :

BIRMINGHAM · BRISTOL · GLASGOW · IPSWICH · LEEDS · LONDON · LOUGHBOROUGH · MANCHESTER · NEWCASTLE · SHEFFIELD B40

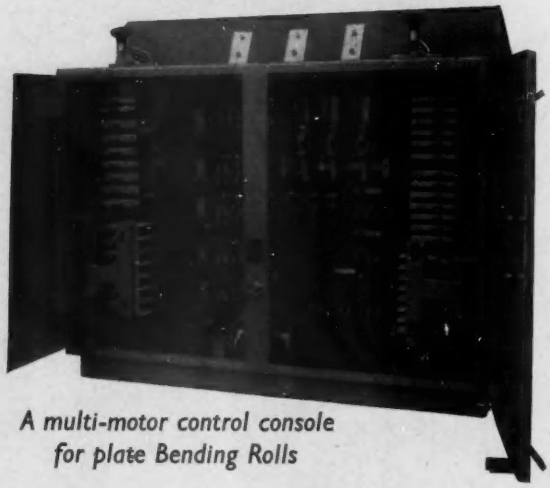
HOLME

HAND & AUTOMATIC CONTROL GEAR FOR A.C. & D.C. MOTORS

A.C. & D.C. ELECTRO MAGNETS & BRAKES

AUTOMATIC "CHANGEOVER" CONTACTORS FOR EMERGENCY OR ALTERNATIVE SUPPLIES

AUTOMATIC CONTROL GEAR



A multi-motor control console for plate Bending Rolls

EDWARD HOLME & CO (1931) LTD

TELEPHONE : ALTRINCHAM 2694-5-6 **ALTRINCHAM · ENGLAND** TELEGRAMS : CONTACT · ALTRINCHAM

"Wanted— the *complete* power station"

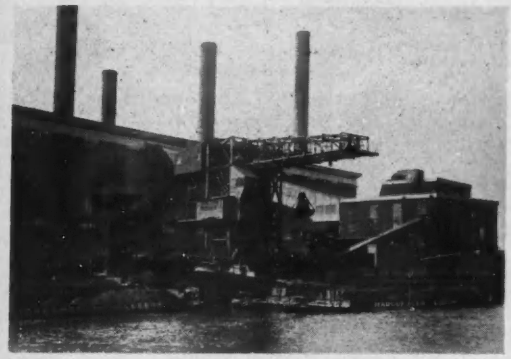
To-day, there is a demand for companies able to supply *complete* Boiler plant—the civil engineering and building work, the mechanical handling plant for the coal, the pipework and firing equipment—in fact, the entire steam raising plant.

Mitchells have had over thirty years' experience of this kind of comprehensive contract, including many stations in the British Isles and overseas contracts like the Station at Athens.

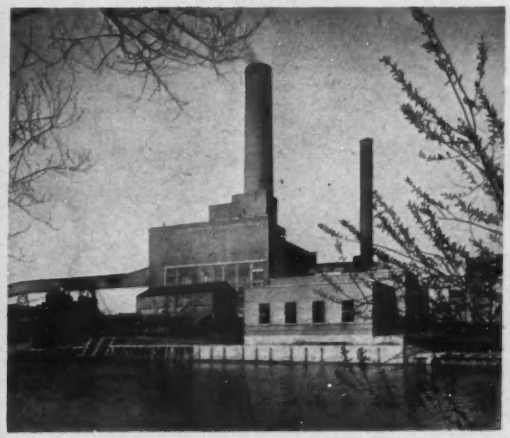
The Mitchell Companies have an international reputation *and* an international background and organisation for this kind of work.

Other Mitchell activities include coal preparation plant, ore handling plant, wagon tippler hoists, wagon marshalling plant, dams, cooling towers, chimneys, cranes, ropeways, etc.

A Mitchell water tube boiler with a drop link Illinois stoker.



Mitchells, who supplied eight boiler units to Ferrybridge Power Station, also supplied this unloading transporter and handling plant for the coal.



The original power station at Peterborough, on the right of the picture, was built by Mitchells and the company has also had important contracts for the later stations.

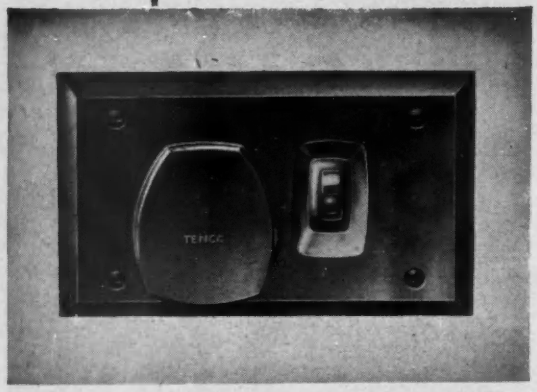
MITCHELL

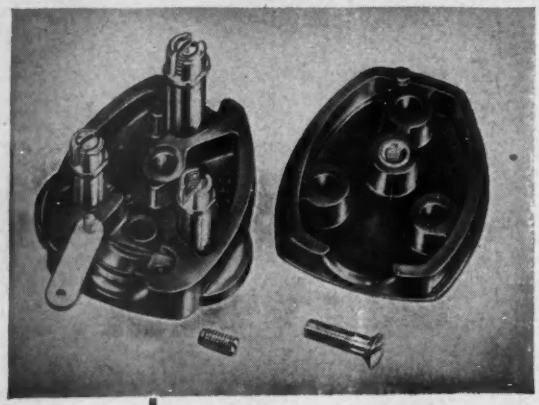
complete power stations — in record time

MITCHELL ENGINEERING LIMITED, ONE BEDFORD SQUARE, LONDON, W.C.1. Phone: MUSEUM 5511

The Mitchell Engineering Group Ltd., John M. Henderson & Co. Ltd., The Mitchell Construction Co., Mitchell Ropeways Limited.

TEMCO





A. C. SWITCH SOCKETS & PLUGS

- ★ 5 and 15 amp. 3-pin to B.S.546
- ★ Surface and Flush
- ★ Single and Double Pole
- ★ Brown and Cream
- ★ Neat, attractive, individually packed
- ★ Designed for easy wiring
- ★ High quality at low price

If you have not received details of these new TEMCO Switch Sockets and Plugs, please write for the full descriptive leaflet.

T.M.C.—HARWELL (SALES) LIMITED
37 UPPER BERKELEY STREET, LONDON, W.1
Telephone: PADdington 1867/8/9

8ft. fittings mounted 8 times their own length

Interior of the Ferranti Transformer Factory, Hollinwood

With mounting heights of 64 ft. this splendid new transformer factory is equipped throughout with Metrovick 8 ft. twin 125 watt fluorescent lamps and fittings. The 1,800 lamps used give an average illumination of 15 lumens per sq. ft.

Please write for brochure ES4123/21 which gives full details of this and other 8 ft. installations.

METROVICK

8 ft. fluorescent lighting fittings

METROPOLITAN-VICKERS ELECTRICAL COMPANY LTD., St. Paul's Corner, St. Paul's Churchyard, London, E.C.4.

Member of the A.E.I. group of companies.

S/F404

ELECTRO METHODS LTD OF STEVENAGE

—the first name for

CARTRIDGE THERMOSTATS

Universally approved by the

ELECTRICAL INDUSTRY

for all purposes demanding ACCURATE temperature control

Thousands of engineers and laboratory technicians rely exclusively on E-M Cartridge Thermostats . . . particularly when the success of a process or mechanism is dependent on specific temperatures being maintained for brief or prolonged periods.

E-M Cartridge Thermostats are simple to install and afford easy adjustment of temperature-setting . . . they are unaffected by vibration and are capable of switching 250 volts AC at 5 amps without an associate power contactor . . . for sensitivity, reliability, compactness, robustness, and instantaneous action they are unequalled.

IN TWO RANGES: −100° to +400° F (Brass Shell) +100° to +600° F (Stainless Steel Shell)

Special Argon-arc welded stainless steel shells supplied for use with corrosive-agents

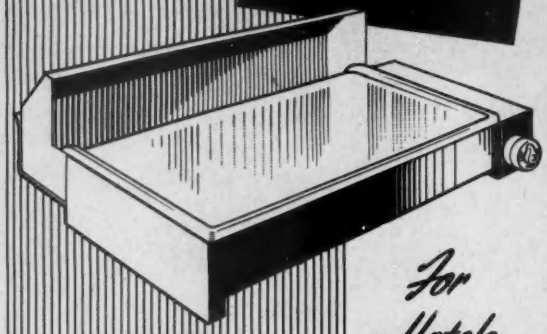
Sensitivity: ± 0.1° F for small loads

IMMEDIATE DELIVERY

ELECTRO METHODS LTD. *also manufacture* RELAYS, ADJUSTABLE-CONTACT THERMOMETERS, MAGNETIC AMPLIFIERS, LOW-INERTIA INTEGRATING MOTORS

Full data from: ELECTRO METHODS LTD. Division TH23 CAXTON WAY, STEVENAGE, HERTS : Stevenage 780

'ARORA' *Electric* GRIDDLE PLATE



AVAILABLE IN THREE STANDARD SIZES FOR AMERICAN STYLE COOKING

Leaflet C505 giving full details of all models will be sent upon request.

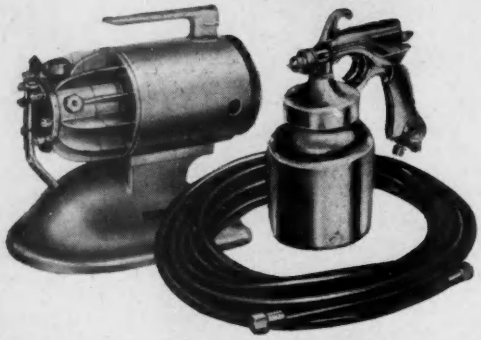
For Hotels, Restaurants and Canteens

256

THE ARORA COMPANY ROSEBERY ST. LOUGHBOROUGH TELEPHONE: 2603

MARTINDALE

ELECTRIC SPRAYER



A small, compact and ultra-lightweight unit that will spray almost any medium at speeds up to one square yard per minute. The equipment comprises: A powerful, sliding vane, automatically lubricated **Compressor.** A lightweight "bleed" type **Gun** with a quart size **Paint Jar.** All necessary **Hoses** and **Connections,** bottle of special oil, funnel, set of tools and alternative nozzle.

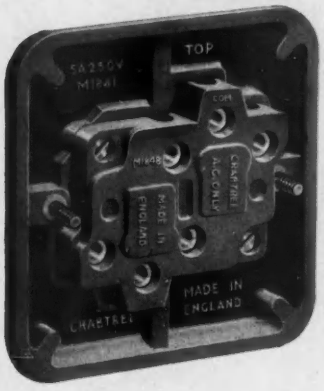
Weight complete about 22 lb. Standard voltages 110, 200/220, 230/250. Special voltages to order.

A pressure feed Container with equipment is available as an extra.

Write for descriptive leaflet to:

MARTINDALE ELECTRIC CO. LTD.
45 WESTMORLAND ROAD, LONDON, N.W.9
also at 25 Elmbank Street, Glasgow, C.2

SWITCH TO THE "LINCOLN" TYPE AC
For Robust Service



- Switch mechanism is protectively sealed against dust, both during and after erection.
- Full, positive drive from dolly to moving contact. Contacts of heavy gauge, silver-inlaid copper.
- Single- or twin-switch units for erection in one-gang extra-shallow or B.S. 1299 boxes.
- A competitive, robust switch in all ways comparable with the other sturdy "Lincoln" wiring accessories.

THE "Lincoln" Type AC flush switch is endowed with exceptional strength and will stand up to rough handling during and after assembly. At the same time, its rugged plate and well-protected dolly are proof against even the mischievous attention of children. The mechanism of this sturdy switch is protected from dust by being recessed into a cavity in the back of the plate—switch and plate being a single composite unit. Excellent contacting is ensured by heavy-gauge, silver-inlaid components. Even severe vibration will not cause the switch to open or close the circuit as there is full, positive drive from the dolly to the moving contact. From any point of view, the "Lincoln" Type AC switch is eminently suitable for the modern installation.

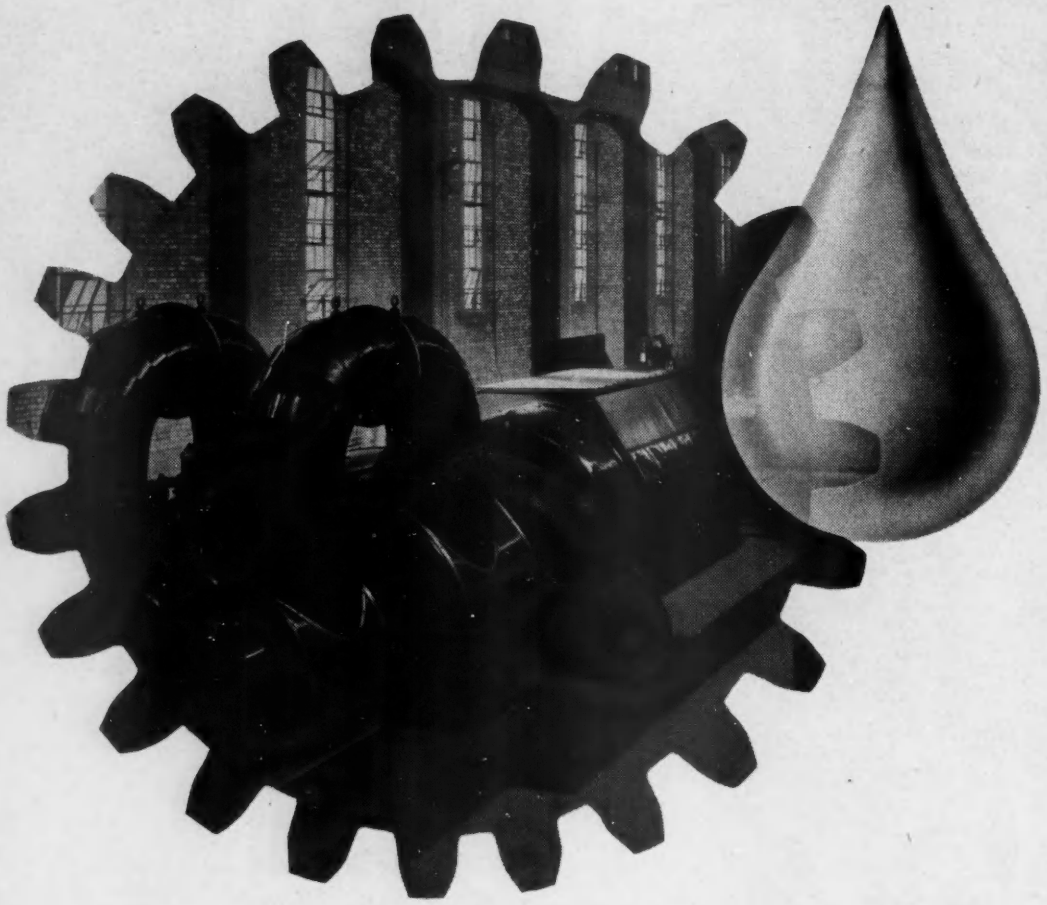
Ask for a copy of Publication No. T152a

CRABTREE

WIRING ACCESSORIES · SWITCHGEAR · MOTOR STARTERS

"Crabtree" (Registered)

C.683 Advt. of J. A. Crabtree & Co. Ltd., Lincoln Works, Walsall, Staffs.



Machinery runs longer and more smoothly on

BP ENERGOL

the engineer's oil

Distributors of BP Energol Lubricants in Great Britain for Industrial and Marine purposes

THE POWER PETROLEUM COMPANY LIMITED

Head Office: 76/86 Strand, London, W.C.2.

TO BRITISH STANDARD SPECIFICATIONS 816 AND 546

5 and 15 amp. PLUGS, SOCKETS and SWITCH SOCKETS
5 amp. 1-and 2-Way TUMBLER SWITCHES

Volex

★ SUPERIOR QUALITY

★ UTMOST RELIABILITY

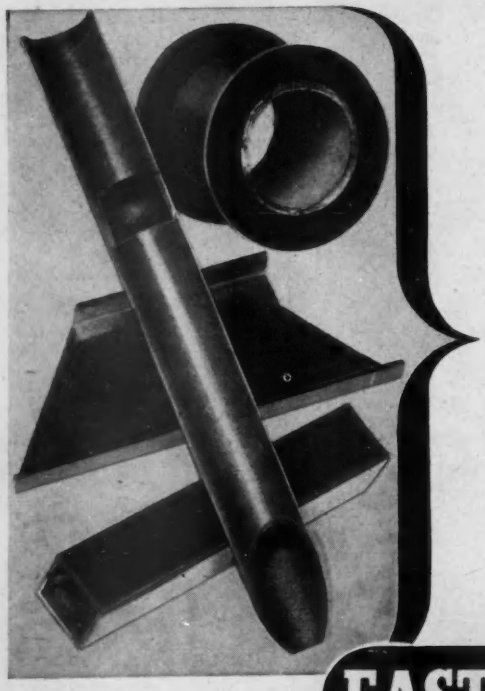
★ SUPERLATIVE DESIGN AND FINISH

The range of "Volex" 5 and 15 amp. Plug Sockets with and without switch, embodies many features which provide maximum safety and efficiency under the most stringent operational conditions.

Volex VOLEX ELECTRICAL PRODUCTS LTD
SALFORD 6

Telephone: PENdleton 4373 Telegrams: "VOLEXPROD", Salford 6

The connection is obvious
H. C. ELECTROLYTIC COPPER WIRE, BARS AND STRIP
By
Spencer Wire
THE SPENCER WIRE CO. LTD., THORNES WIRE MILLS, WAKEFIELD, YORKS.



BAKELITE
Electrical Insulation

We manufacture and fabricate all types of Laminated Bakelite Insulations.
Send us details of your requirements, and we shall be pleased to quote.

EAST LONDON MICA WORKS
RINGWOOD RD., WALTHAMSTOW, LONDON, E17
ESTD. 1912

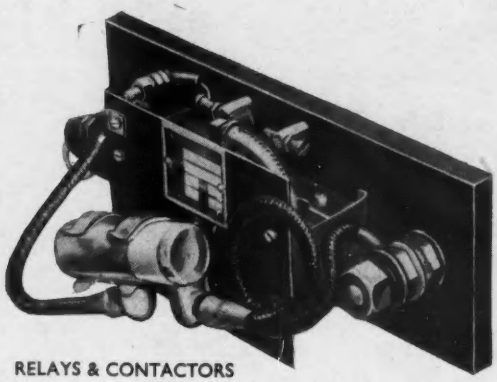
Telephone:
COPpermill 2248/9
Telegrams:
Elmicmer, Easphone, London

Engel & Gibbs

RELIABILITY

Also manufacturers of

- ★ Plug in and telephone type relays
- ★ Control panels
- ★ Mercury switches
- ★ Zebra flashers
- ★ Miniature adjustable contact thermometers



RELAYS & CONTACTORS

THROUGH & THROUGH . . .

The safest and most reliable method of load control. Available in every type of construction for currents up to 150A T.P.

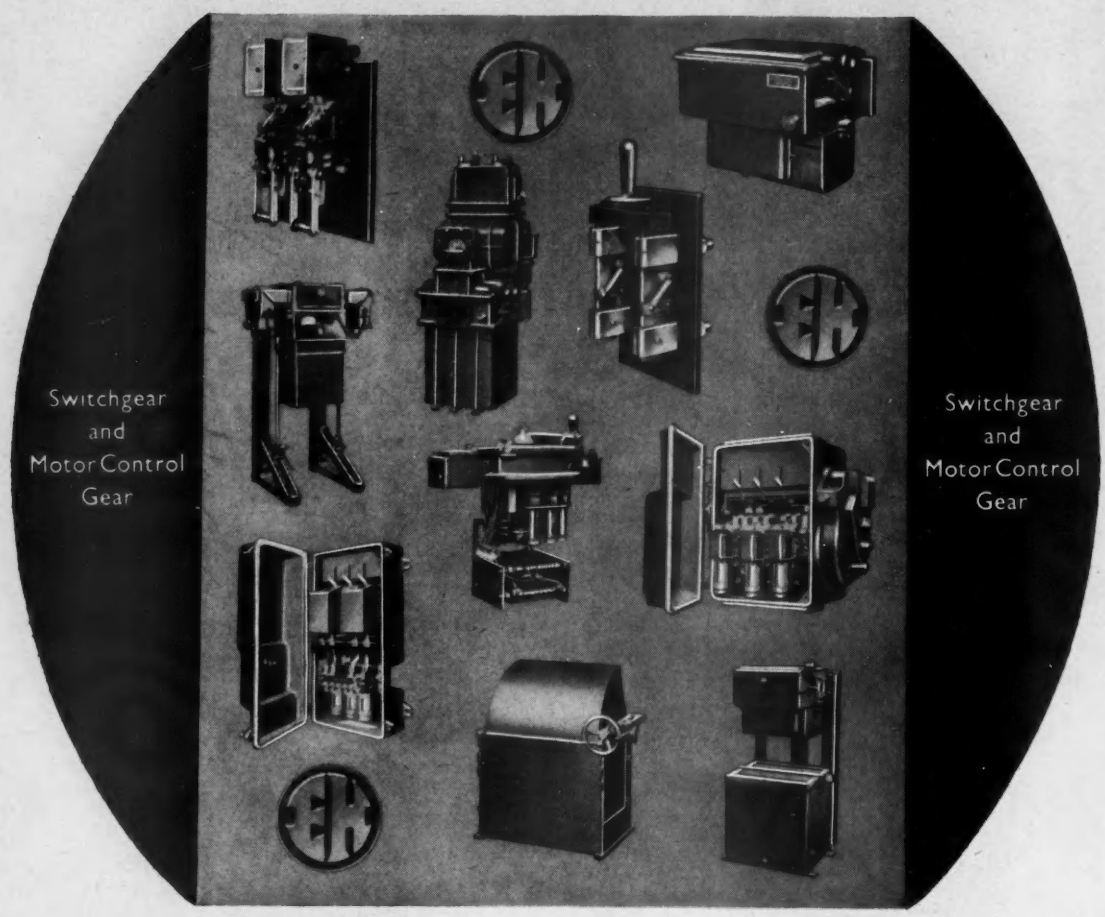
ENGEL & GIBBS LTD.

WARWICK ROAD : BOREHAM WOOD : HERTS

Telephone: Elstree 2291/2/3/4 Telegrams: "Tormometer, Boreham Wood"

Standardise on "Erskine Heap"

SPECIALISTS IN THE MANUFACTURE OF SWITCHGEAR SINCE 1905



It's the Switchgear engineers like to *"Live"* with

L.T. SWITCHGEAR *50/5000 AMPERES*
E.H.T SWITCHGEAR *up to 11 kV 250 MVA rupturing capacity*
MOTOR CONTROL GEAR *¼/5000 H.P.*

May we have your enquiries?

ERSKINE, HEAP & Co LTD

SWITCHGEAR SPECIALISTS

Head Office and Works
BROUGHTON, MANCHESTER (7)

London Office
GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

6378

Osram

SODIUM LAMPS

are used in the
largest streetlighting
installations

•

SPECIFY BY NAME

Osram

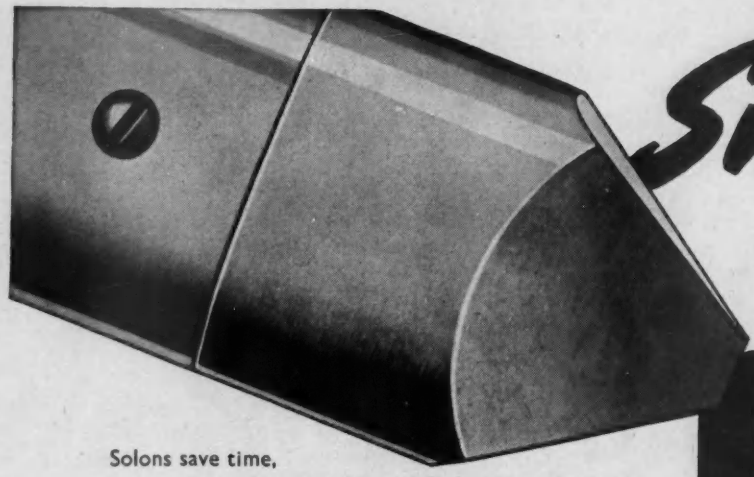
SODIUM LAMPS

for

HIGH EFFICIENCY-
RELIABILITY-
STAMINA

A G&C PRODUCT

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.



Switch on to

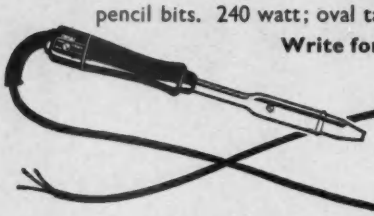
HENLEY SOLON

TRADE MARK

ELECTRIC SOLDERING IRONS

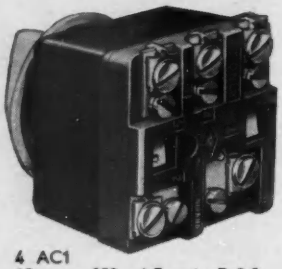
Solons save time, reduce costs. Solon soldering is always clean, reliable and simple. Five models, in voltage range 100-250; each with 6 feet Henley flexible. 65 watt; oval tapered or round pencil bits. 125 watt; oval tapered or round pencil bits. 240 watt; oval tapered bit.

Write for folder Y.10

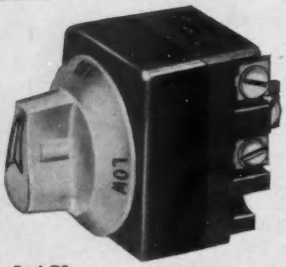


W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51-53 HATTON GARDEN, LONDON, E.C.1

ELECTRICAL CONTROLLING DEVICES



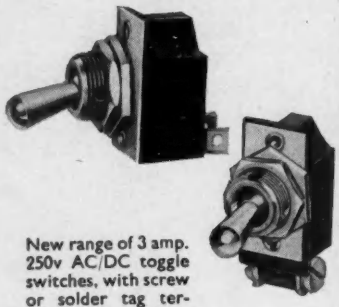
4 AC1
15 amp. 250v AC only D.P.3 heat rear wiring $1\frac{3}{4}$" deep. Designed to conform with European specifications.



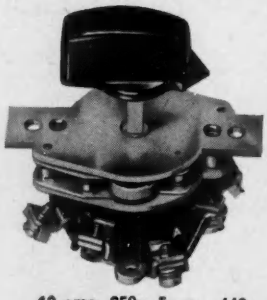
5 AC3
15 amp. 250v S.P.3 heat for standard side wiring, also available for rear wiring.

FAMOUS OVER THE WORLD

"Diamond H" controlling devices have all the traditional craftsmanship and skilled experience in design accumulated in over 60 years of specialised manufacturing.



New range of 3 amp. 250v AC/DC toggle switches, with screw or solder tag terminals, also available with biased action.



10 amp. 250v, 5 amp. 440v AC/DC and AC only 4 position switches for panel or base mounting. 30-60 amp. size also available.

"DIAMOND H" SWITCHES LTD
GUNNERSBURY AVENUE, CHISWICK, LONDON, W.4
***Telephone*: CHISWICK 6444/6/7/8**

MODERNISING THE WORLD'S RAILWAYS

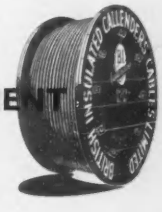
Increased track capacity by BICC electrification

Many railways are increasing their track capacity from 50 to 100 per cent by electrification. You'll find an example in London, at Liverpool Street Station. Within two months of electrification, passenger traffic on the line to Shenfield increased by over half.

In Australia they are out to *double* the freight capacity of the Sydney-Lithgow Line (N.S.W. Government Railways) by the same means.

The BICC Group are responsible for the design, manufacture and installation of overhead traction equipment for both these schemes—and many others of a similar nature throughout the World. This Company also designs and manufactures signalling cables, power feeder cables and associated equipment. Their Branches and Agents are at the service of Railways —everywhere.

BICC **OVERHEAD TRACTION EQUIPMENT & SIGNALLING CABLES**

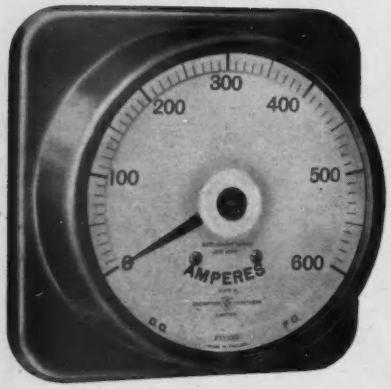


BRITISH INSULATED CALLENDER'S CABLES LIMITED
21, BLOOMSBURY STREET, LONDON, W.C.1 MUSEUM 1600

C

The man who lost an Ampere

Don't blame Mr. Brown if his faulty reading put everybody else's calculations out of joint. Better have a look at the ammeter first. It's probably got one of those dials that are so cramped they would mislead anybody without the eyes of a hawk. That sort of thing wouldn't happen with a Crompton Parkinson instrument, where readability plays just as important a part as accuracy, dependability and quality of finish. The circular scale ammeters illustrated have 4 in. or 6 in. dials with scales 7 in. and 10 in. long respectively and are made for projecting or flush mounting, either moving coil or moving iron type. They are neat, easy to read and save space, weight and cost.



When it comes to ELECTRICAL INSTRUMENTS

you've got to hand it to . . .

Crompton Parkinson LIMITED

ELECTRICAL EQUIPMENT

CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2 TEL: CHANCERY 3333

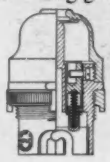
Ashley Regd. B.C. LAMPHOLDERS

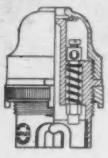
Eight types of "Ashley" B.C. Lampholders, listed in one hundred and thirty-two variations. All are well designed, precision made from the best materials, and quality controlled. Each one is "Ashley" branded, guaranteed, and reasonably priced.

FEATURES. Moulded, or with porcelain interiors. Brown or white. Brass liners. Spring or solid plungers, with non-rust springs. Easily wired terminals. Lug grip shade carrier rings with brown holders. White holders have short shields. Home Office pattern ventilated shields. Excellent finish. Complying B.S. 52.

SPRING PLUNGERS

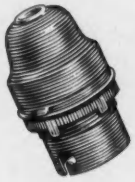
Terminals stationary during lamp insertion or removal.





SOLID PLUNGERS

Terminals move during lamp insertion or removal.



CORD GRIP

Spring or solid plungers. Has effective cord grip. One type lamplocking, key operated.

CORD GRIP 'DREADNOUGHT'

Heavyweight, with porcelain interior, solid plungers, non-rotating cap, and effective cord grip.

THREADED

Spring or solid plungers. Choice of six threads:—
$\frac{3}{8}$", $\frac{1}{2}$", $\frac{5}{8}$" brass,
$\frac{1}{2}$", $\frac{5}{8}$", $\frac{3}{4}$" conduit.

T.R.S. GLAND

Spring or solid plungers. With screwed bush and grommet, to grip 14/.0076 round twin T.R.S.

BATTEN

Spring plungers. Easily wired body removes from base rear. 2" fixing centres. Available with "loop-in" third terminal.

SIGN

Spring or solid plungers. With shade carrier ring. Without cap. For clamping through a metal or other plate.

ANGLED BATTEN

Angled 45°. Spring plungers. Easily wired body removes from base rear. 2" fixing centres. Available with "loop-in" third terminal.

FESTOON STRIPLIGHT

Spring plungers. Black. Clamps on and connects to flat twin T.R.S. Weatherproofing sleeve and grommet available.

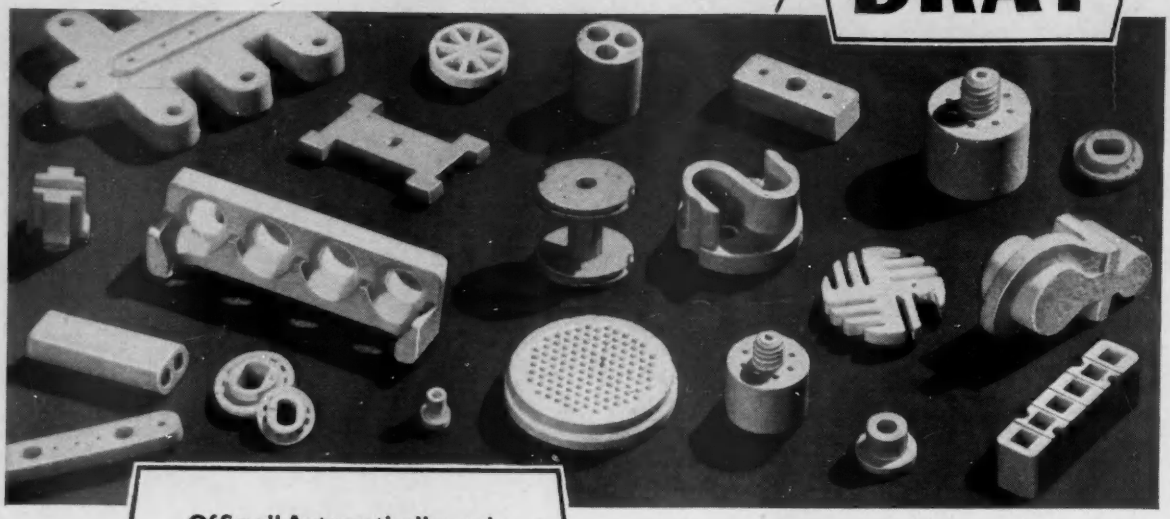
"Ashley" Home Office pattern shield

LIGHT UP WITH

Ashley Regd. GUARANTEED ELECTRICAL ACCESSORIES REGD.

ASHLEY ACCESSORIES LTD
ULVERSTON, LANCASHIRE
Phone: Ulverston 3333 Grams: Ashley, Ulverston
MEMBER OF THE "ASHLEY" GROUP

PRECISION PRODUCTION *by* BRAY



Of Small Automatically made Ceramics to Fine Tolerances for the Telecommunication, Radio and Electrical Trades.

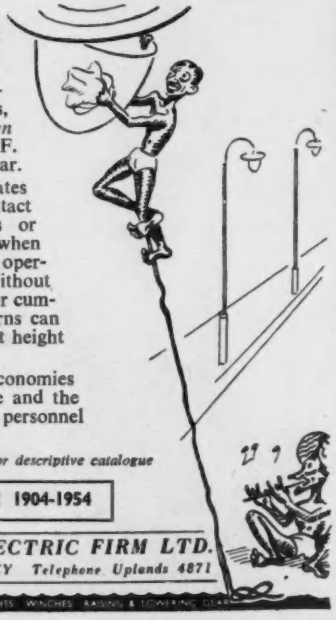
GEO. BRAY & CO. LTD.
LEICESTER PLACE, LEEDS 2
Tel. Leeds 20981/9 Grams. "Bray Leeds 2"

One way of reaching it—

Lights that are out of reach can present a somewhat "tricky" problem when it comes to maintenance. The easiest and most convenient way to service inaccessible lights in Factories, Street Lighting systems, Aircraft Hangars, etc., is to bring them *down* to earth by means of L.E.F. Raising and Lowering Gear.

This equipment incorporates an ingenious electrical contact mechanism which makes or breaks with the mains when actuated by a hand winch operated from the ground. Without the fuss of ladders or other cumbersome equipment, lanterns can be lowered to a convenient height for maintenance.

It also effects substantial economies by reducing servicing time and the number of maintenance personnel required.



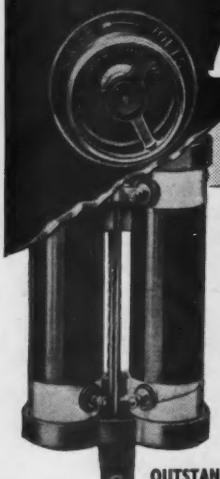
For full details send today for descriptive catalogue

JUBILEE 1904-1954

LEF LONDON ELECTRIC FIRM LTD.
SOUTH CROYDON · SURREY *Telephone Uplands 4871*
SPECIALIST MANUFACTURERS OF SEARCHLIGHTS, WINCHES, RAISING & LOWERING GEAR

TIB 53

Exactitude of control *by* ISENTHAL Sliding RHEOSTATS



Designs for "Back of Board" or for bench mounting for laboratory work

Giving a performance superior to that of the finest multi-contact rheostats, ISENTHAL Tubular Sliding RHEOSTATS are designed to stand up to continuous heavy service and provide infinitely variable current in the circuit. Main insulation is of vitreous Enamel. Terminal stems are so constructed that they cannot turn and allow the wire to slacken or break.

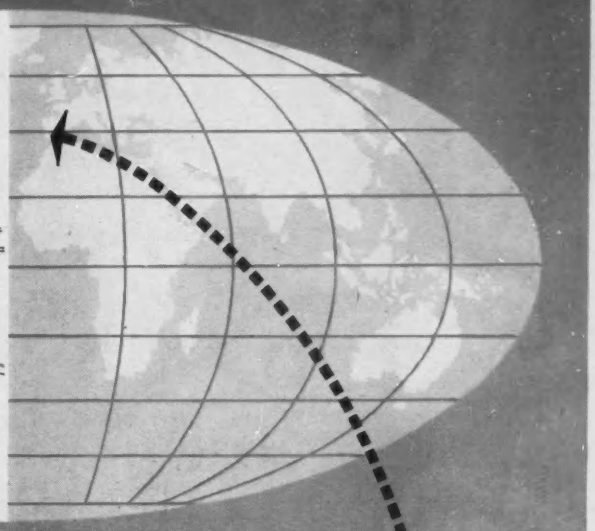
OUTSTANDING ADVANTAGES INCLUDE:

- **Finer Regulation**
- **Greater Accessibility**
- **Light Weight**
- **Better Space Factor**
- **Self-Cleaning Contacts**
- **Robust Construction**

We will gladly supply full details upon request

ISENTHAL & CO. LTD. Ducon Works
Victoria Road, North Acton, London, W.3
Telephone: ACOrn 3904 *Telegrams:* Isenthal, London

IS. 9



PORTUGAL

another country using . . .

Portugal is among the many overseas countries to which TELCON Paper Insulated CABLES are exported for power distribution and transmission requirements. They are available in a complete range and in all voltages up to 22 kV. Your enquiries are invited.

TELCON PAPER INSULATED CABLES

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD

Works: **TELCON WORKS, GREENWICH, LONDON, S.E.10** *Telephone: GREenwich 3291*

Branch Office: **43 FOUNTAIN STREET, MANCHESTER 2** *Telephone: CENtral 0758*

IF your EQUIPMENT, PLANT or PROCESS demands a STEADY POWER SUPPLY...

you need a FOSTER AUTOMATIC VOLTAGE REGULATOR

Visit our Stand No. C.17
at the Mechanical Handling Exhibition, Olympia,
June 9th-19th

Regulators similar to that illustrated above have been supplied to diverse industries in sizes ranging from 10 kVA to 400 kVA. In addition to which, many special types of regulators have been designed for building into customers' own equipment. Our specialist engineers would be glad to discuss your problems and perhaps show you where the efficiency of your plant can be improved by ensuring a "Steady Power Supply".

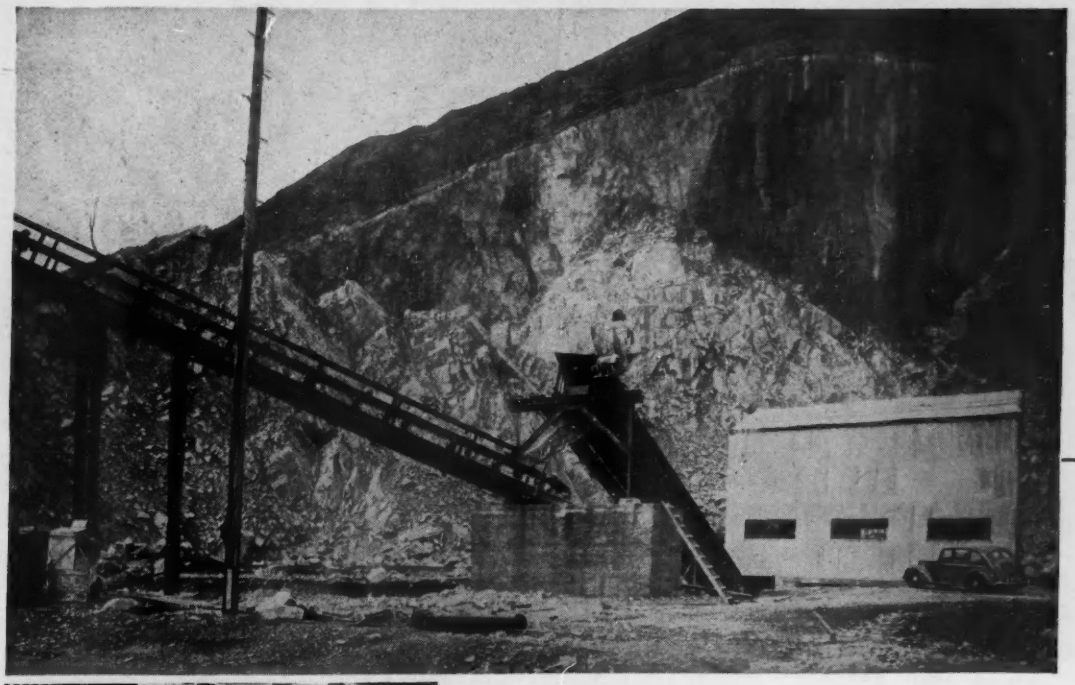
It pays to solve Voltage Problems before they happen!

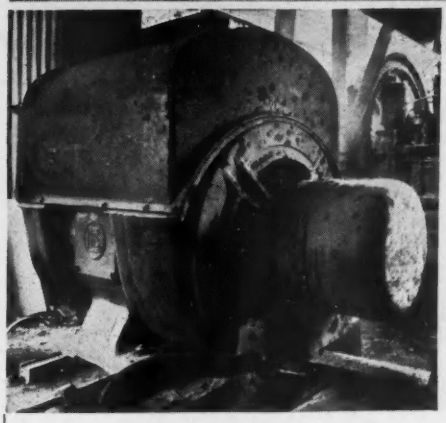
FOSTER TRANSFORMERS LTD. SOUTH WIMBLEDON LONDON S.W.19

A 'LANCASHIRE DYNAMO HOLDINGS' COMPANY

VR.1

Electric Drives for Quarries





'ENGLISH ELECTRIC' have developed a range of electric motors suitable for the many mechanised jobs in the modern quarry.

These motors give maximum reliability in gritty and dusty atmosphere irrespective of whether they are operating drills, compressors, screens, crushers or conveyors.

The motor illustrated, left, is an 'ENGLISH ELECTRIC' totally enclosed, closed air circuit, 100 h.p. 725 r.p.m. slip ring motor driving, through vee belts, a 36 in. x 24 in. primary crusher in a Scottish quarry.

'ENGLISH ELECTRIC'

industrial motors

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Industrial Motor Works, Bradford

WORKS · STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

BM.I

"Castle" Precision

Repetition work in all Metals

Precision turned and screwed

Machining & Light Assemblies

THE CASTLE ENGINEERING COMPANY (NOTTINGHAM) LTD

Haslam Street, Castle Boulevard

Nottingham . Tel : 46088 (3 lines)

SB

SMART & BROWN (ENGINEERS) LIMITED

FLUORESCENT LIGHTING

IFA4

Smart & Brown offer the complete Fluorescent Lighting Service....

CAT. Nº UT 15

THE FITTING TO INSIST ON!

Head Sales Office :

8 Rose & Crown Yard, King Street, St. James's,

London, S.W.1.

Telephone : Whitehall 8267/8.

British European Airways Photograph

at the B E A Engineering Base, LONDON AIRPORT

J. & P. HAVE SUPPLIED . . .

This new Engineering Base now being completed for British European Airways will soon be catering for the bulk of their fleet and providing employment for no less than 1,200 engineers, technicians and staff.

The four substations feeding the base are equipped with J. & P. Transformers and Switchgear (h.v. & l.v.), and for the main power supplies, J. & P. Aluminium Sheathed Power Cables have been used exclusively.

Consulting Civil Engineers:
MESSRS. SCOTT & WILSON, KIRKPATRICK & PARTNERS
Consulting Electrical Engineers:
MESSRS. BARLOW, LESLIE & PARTNERS
Electrical Contractors:
MESSRS. RASHLEIGH PHIPPS & CO. LTD.

Specialists in Industrial Electrification

H.V. & L.V. SWITCHGEAR

•

TRANSFORMERS

•

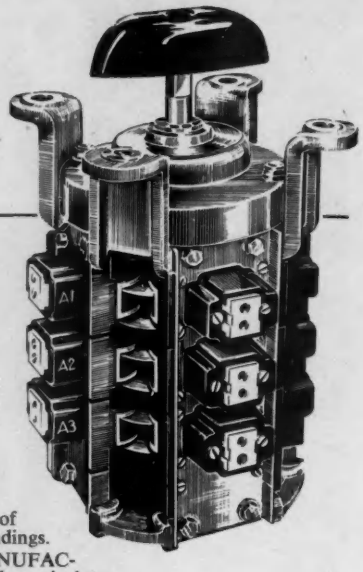
ALUMINIUM SHEATHED POWER CABLE

JOHNSON & PHILLIPS LTD.
CHARLTON, LONDON, S.E.7

NEW 200-300 AMP

SANTON

heavy duty rotary switch



With these advantages

* AN ON-LOAD switch with high rupturing capacity.
* COMPACTNESS which is usually associated with equipment of much lower rating—essentially a panel mounting switch.
* FLEXIBILITY due to wide range of switching sequence arrangements which are possible as with our normal range of switches.
* AUXILIARY CONTACTS for remote indication or electrical interlock can be provided by the ganging of one of our small rotary switches to the shaft extension at the rear.

And these applications

TRANSFORMER MANUFACTURERS find it useful on Tap Changing and as a convenient method of varying connections to windings.
SWITCH PANEL MANUFACTURERS now have available an isolator or changeover switch which, in spite of the heavy rating, can be mounted at back of panel.
DISTRIBUTION ENGINEERS can supply various circuits at will, and use it for changing over mains to emergency supply.
BATTERY VEHICLE MANUFACTURERS may utilise it as a reversing and isolator switch of adequate capacity.
ELECTROPLATERS and thousands of others will find numerous applications for this new and versatile switch.

Full details from

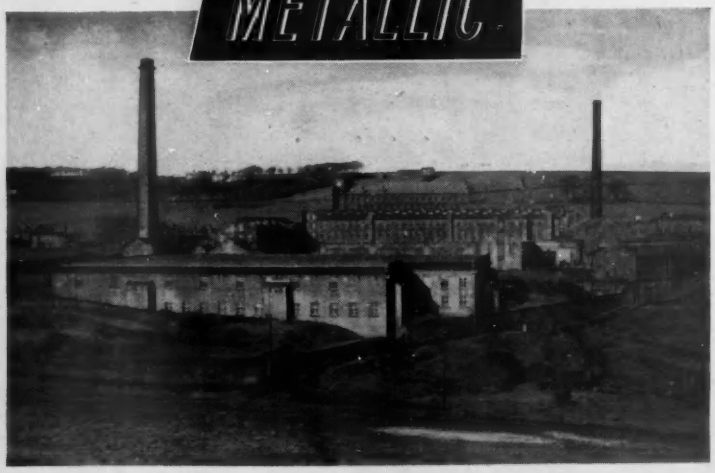
SANTON LTD - Newport - Mon.

Telephones: Newport 71711. Manchester Cen. 1394/5. London Shepherds Bush 3311. Birmingham Mid. 6421. Newton Abbot 1638. Leeds 59361

CONDUIT & FITTINGS SUPPLIED BY

METALLIC

A TI COMPANY



It may be a School, it may be a Factory—a Power Station or a Housing Estate, but more often than not the electrical specification will be—METALLIC.

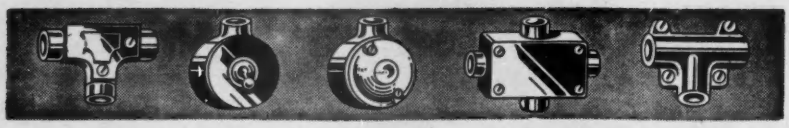
This Yorkshire Mill is no exception, being fitted throughout with METALLIC Conduit and Fittings—unequalled for quality and consistent accuracy.

Denholme Mills, Nr. Keighley. Photo by courtesy of W. & H. Foster Ltd.

Electrical Contractors: A. R. Farrar & Co., Ltd., Bradford.

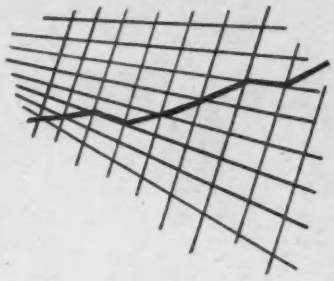
THE METALLIC SEAMLESS TUBE CO. LTD.

LUDGATE HILL • BIRMINGHAM • 3



ALSO AT LONDON • NEWCASTLE-ON-TYNE • LEEDS • SWANSEA & GLASGOW

to increase YOUR sales



Stylish designs, attractive prices, plus efficient service, are some of the reasons why Premier "Pylon" Kettles are so popular. Fitted with effective safety device the "Pylon" Kettle will give your customer COMPLETE PROTECTION if boiled dry. Over forty-five years' experience in the manufacture of Fine-Quality appliances is your customers' guarantee for lasting satisfaction.

Aluminium "Pylon"

Soundly constructed made of heavy gauge aluminium and highly polished. Attractively priced at 55s. 6d., 1,500 watts, Cat. No. 2833, and 52s. 6d., loading 1,000 watts, Cat. No. 2833/A. Both models 3 pints.

Chromium Plated Copper "Pylon"

Made of heavy gauge copper, exquisitely finished in lustrous chromium plate. Cat. No. 2939, loading 1,500 watts, £3 17s. 6d. Cat. No. 2939/A, loading 1,000 watts, £3 14s. 6d. Both models 3 pints. Cat. No. 2947, 1,500 watts, £4 6s. 0d., 4½ pints capacity.

backed by press advertising

Extensive advertising in the popular press will make sure your customer asks for the Premier "Pylon". Counter-stands, leaflets to help your Premier sales available—why not ask for them with your next order !

PREMIER
Fine-Quality

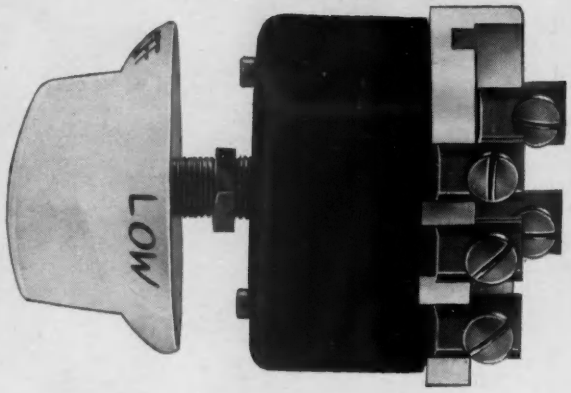
"Pylon" fully automatic electric kettles

PREMIER ELECTRIC HEATERS LIMITED - BIRMINGHAM 9

Member of the A.E.I. group of Companies

TOK takes the lead with this NEW HEAT CONTROL SWITCH

Suitable for Cookers, Hot Plates, Wash Boilers, etc.
Liberal rating at 15 amp 250 v AC
Single or double Pole
Robust Terminals
Standard Fixing
Ceramic Base
Moulded Cover
Ask for Pamphlet No. 18



TOK

Address your enquiries to :
TOK ELECTRICAL & INDUSTRIAL MECHANISMS LTD.
264-270 ST. JOHN STREET, CLERKENWELL, E.C.1 *Telephone : Clerkenwell 2917*

DEPENDABLE DELIVERY

E.W.F. ELECTRICAL WHOLESALERS FEDERATION MEMBER

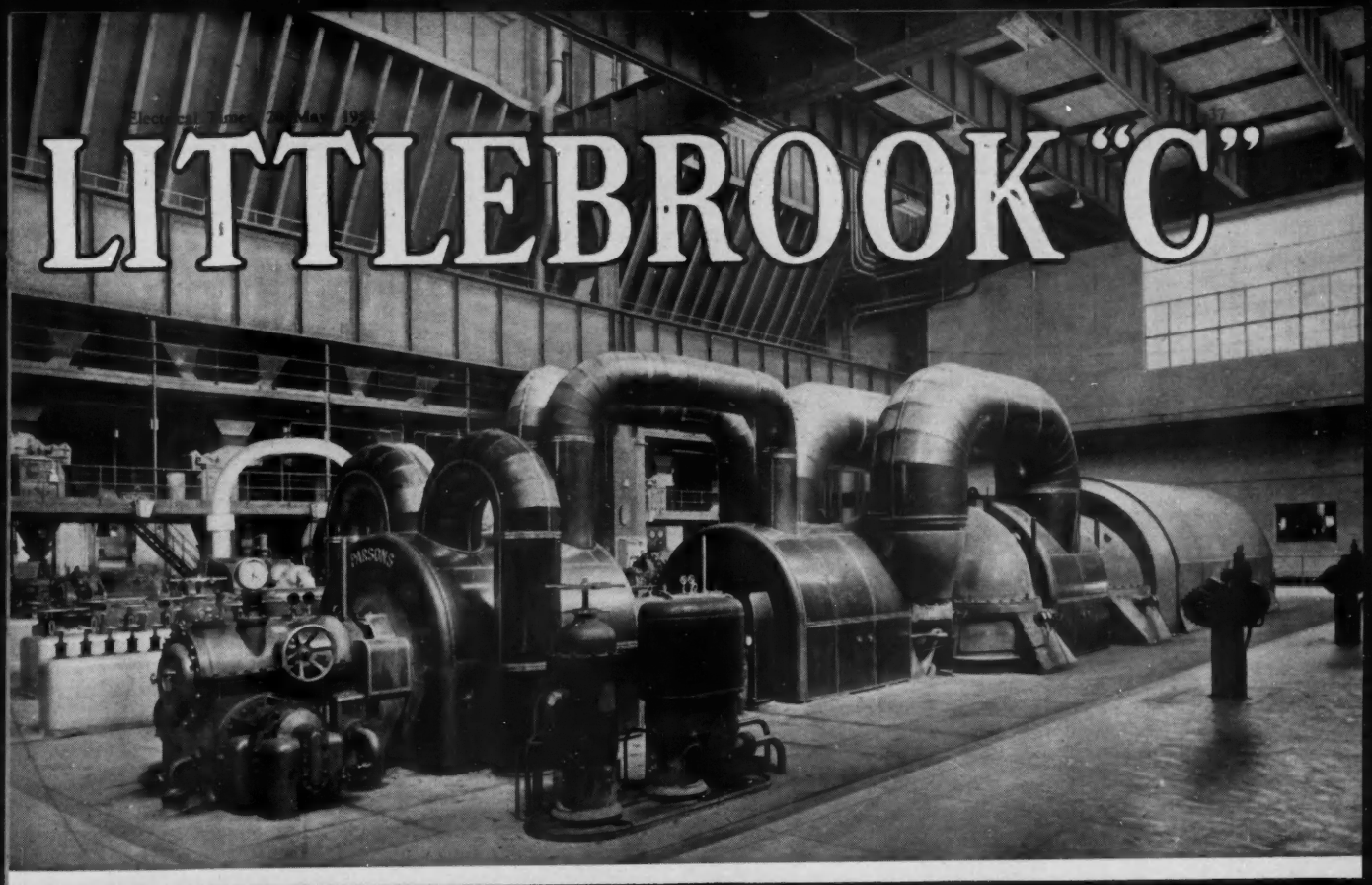
EVERY DESCRIPTION OF ELECTRICAL MATERIAL FOR EVERY SITUATION

WE HANDLE HIGH-CLASS MATERIAL ONLY

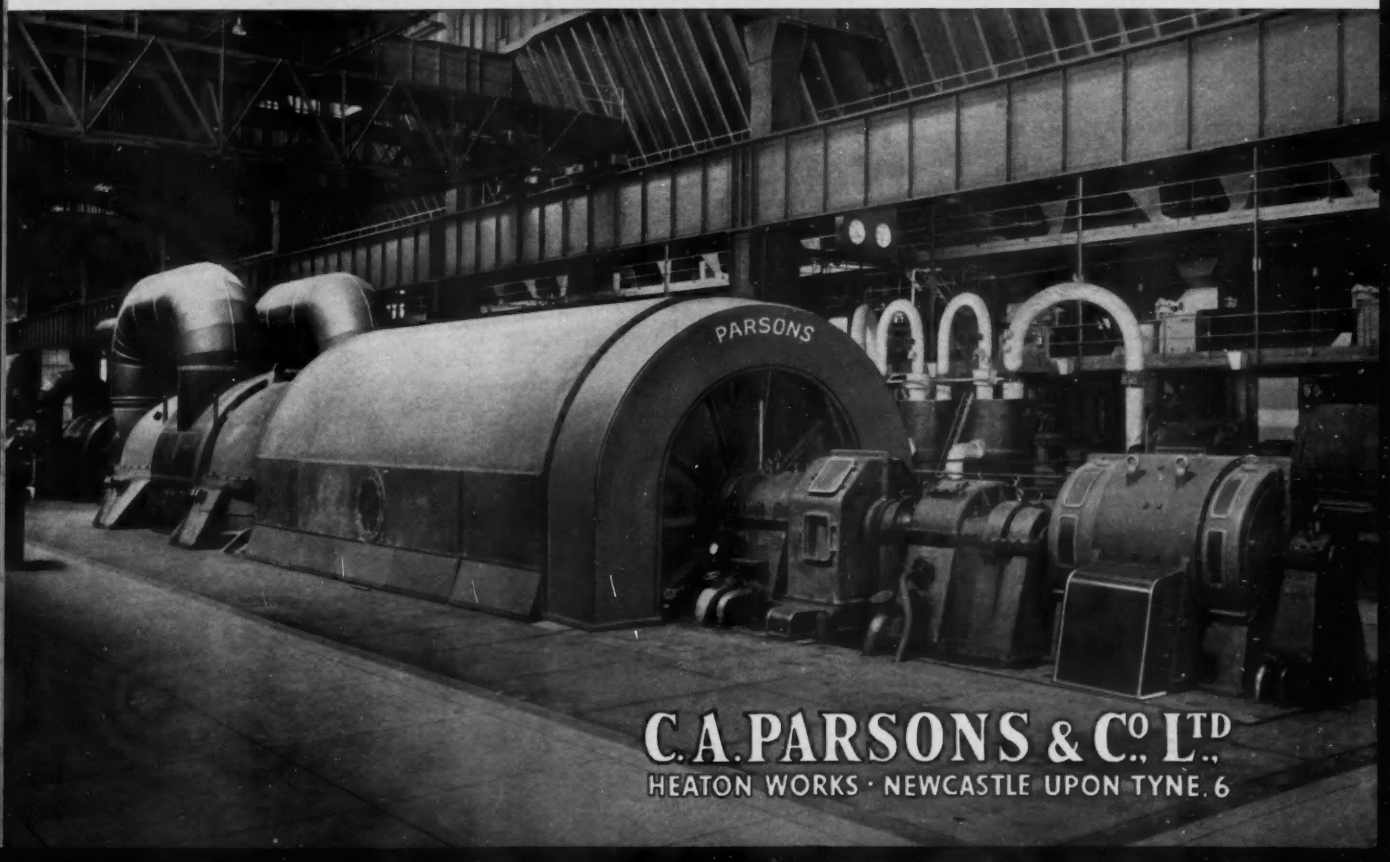
OUR ADDRESSES :

LIVERPOOL 1-9 Stanley St.
MANCHESTER 30 Pall Mall
CARLISLE Paternoster Row
BIRKENHEAD 94 Chester St.
WORKINGTON Oxford Buildings Oxford Street

DOWNES & DAVIES LTD



HYDROGEN COOLED TURBO-GENERATORS



C. A. PARSONS & Co., LTD.
HEATON WORKS · NEWCASTLE UPON TYNE. 6

PROSCON

Watertight
Pattern Industrial
Immersion Thermostat
for water, oil or other liquids.

Housing the popular NU series Immersion Thermostat, an attractive robust die cast aluminium enclosure fully watertight and suitable for ¾" conduit. Instruments for high and low temperature are available in various lengths with 2 or 3 contacts and manual reset.

Please send for LIST IT/453

PROCESS CONTROL GEAR LTD.
56 VICTORIA STREET · ST. ALBANS · HERTFORDSHIRE
TELEPHONE:- ST. ALBANS 2030 & 6689 TELEGRAMS:- PROCONGEAR, ST. ALBANS

"Dun-Low" **ELECTRIC IMMERSION HEATERS**
with safety switches

Horizontal Type

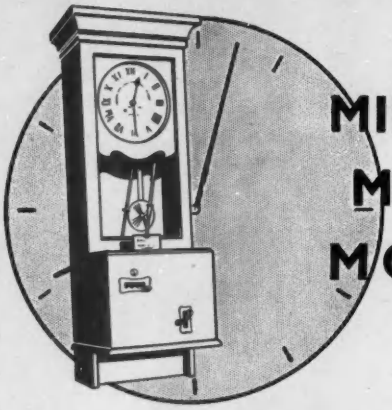
Vertical Type

Vertical bottom fixing Type

For Water Boilers, Sterilizers and vessels where the water is liable to fall below the level of the heater.

Send for Catalogue [No. 107 Section 2, June 1951

DUNCAN LOW LIMITED
293 Bell Street, Glasgow, C.4.
'Phone : Bell 1961 'Grams : "Immerser, Glasgow"



MINUTES MEAN MONEY

Waste of any kind is uneconomic. Waste of time, in the present industrial situation, is a most serious form of waste. The Gledhill-Brook Recorder checks time at every minute of every hour and provides a permanent, detailed record for analysis and filing. There is a Gledhill-Brook System for every worker and every job in industry.

GLEDHILL-BROOK
TIME RECORDERS and Costing Systems

Enquiries to
GLEDHILL-BROOK TIME RECORDERS, LTD
60, EMPIRE WORKS, HUDDERSFIELD

A NEW-PRINCIPLE A-C AUTOMATIC VOLTAGE STABILISER

We have now had released to us by a Government Department the design of our "A.C. Mains Regulator, Automatic, Step, Mark II", and are therefore manufacturing this unit for general sale. It ideally fills the need for a cheap, small and light Stabiliser. Although it measures only 8½in. x 4½in. x 5in., weighs as little as 11 lbs., and costs only £24 net, it has a performance fully equal to any similarly rated Automatic Stabiliser of the resonated, saturated core type, without any of the disadvantages.

ASR-1150 has a pure output waveform, is unaffected by changes in mains frequency, and works equally well from no-load to full load, which is 1150 VA. It has a stabilised output at 230V unless otherwise ordered.

Many other Automatic Voltage Stabilisers are now manufactured by us, and all are available for immediate delivery. In some cases the constancy of output is as high as 0.15%. Models are available from 200 VA to 30 kVA, single phase. 3-Phase Stabilisers are also available. Prices are *extremely* competitive.

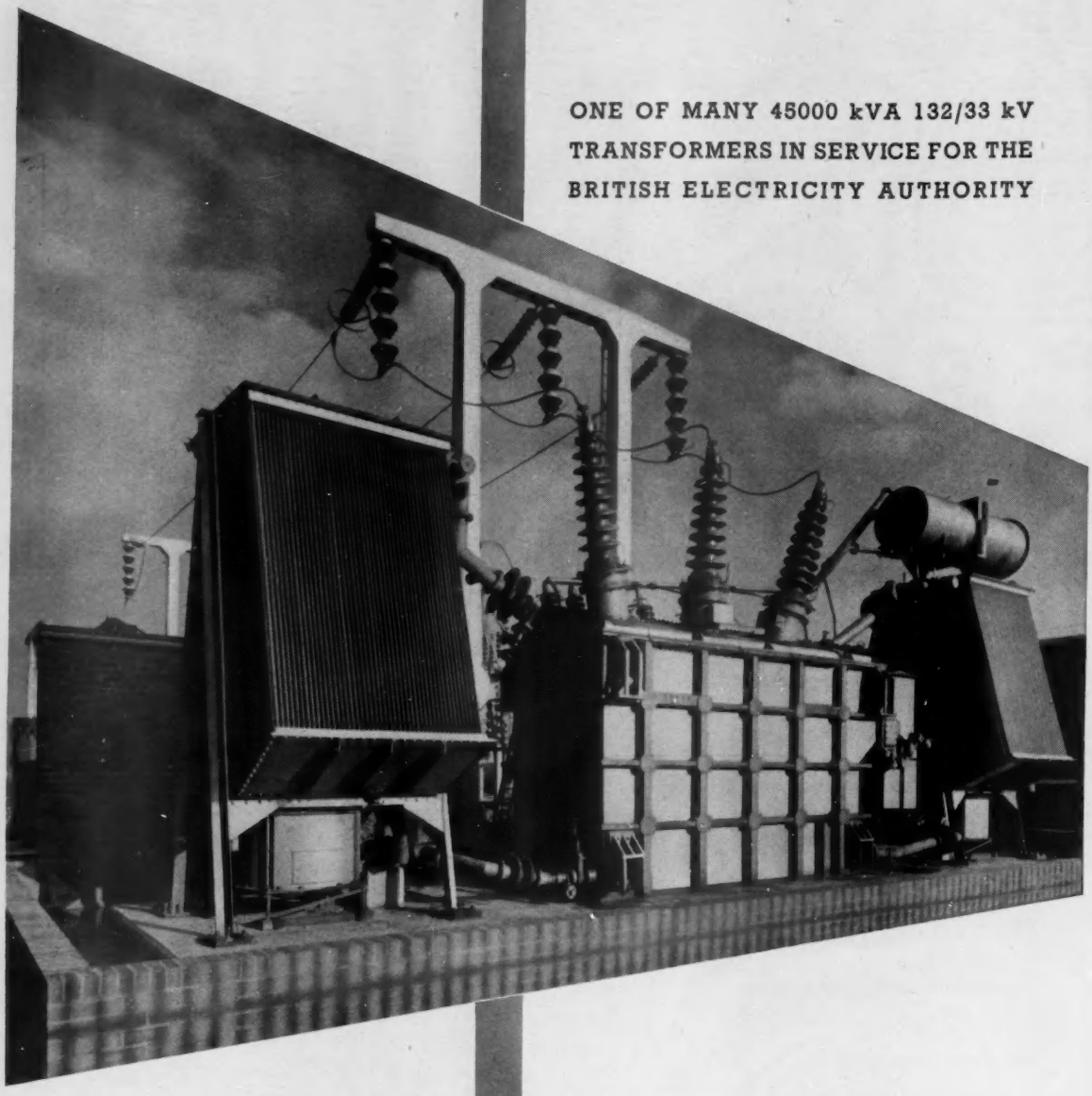
We can supply from stock all types of American tubes, condensers, valves, potentiometers, etc.

The *NEW "ASR-1150"* costs only £24 net

Complete information is obtainable from:

CLAUDE LYONS LTD., *STABILISER DIVISION,*
QUEEN'S HOUSE, 180-182 TOTTENHAM COURT ROAD, LONDON, W.1
(Telephone MUSeum 3025-6 Ext. 13)

MEMO: If you are interested in infinitely-variable Transformers, do not forget the almost indispensable "VARIAC" (Reg'd. Trademark). Models are available from 170VA to 21kVA. Our Catalogue V-549 (3rd Edition) tells the whole story, and will gladly be mailed free and post free, on request.



ONE OF MANY 45000 kVA 132/33 kV TRANSFORMERS IN SERVICE FOR THE BRITISH ELECTRICITY AUTHORITY

G.E.C. POWER TRANSFORMERS

THE GENERAL ELECTRIC CO. LTD · MAGNET HOUSE · KINGSWAY · LONDON · W.C.2

ELECTRICAL TIMES

THURSDAY, 20 MAY, 1954
Volume No. 125 Number 3263
REGISTERED AS A NEWSPAPER

ESTABLISHED 1891

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2.
Telephone: HOLborn 6016
Telegrams: Equivolt, Estrand

Editor and Managing Director:
ROY BALDWIN, M.I.E.E., Barrister-at-Law

Assistant Editors:
J. K. JOHNSON, B.SC.(ENG.), A.M.I.E.E.
K. C. POUNDS, B.SC.(ENG.), A.C.G.I., A.M.I.E.E.

In This Issue

Radio Communication as an Aid to Power System Operation, Part I, by *R. E. Martin*, D.F.H., A.M.I.E.E. 731
Reorganisation in Scotland 734
Paper and V.C. Insulated Cables Uprated 735
Rapid Starting Power at Stations 736
Notes on Wiring by *Megohm* 737
More Power from Niagara 738
Lighting in the Royal Yacht 740
Improved Arc Welding 741
Britain's Fuel Future 742
Understanding from Measurements 742
The Production of High Quality Discharge Lamps 743
Compatible Systems for Colour TV ... 744
The Ultrasonic Drill 745
Overseas News 746
Personalities in the Industry 748
New Literature 750
Problems and Practice in Engineering ... 751
Equipment for Industry 752
For the Electrical Trade 753
News of the Week 754
Questions in Parliament 758
Company Activities 759
Electric Supply News 760
INDUSTRIAL MAINTENANCE Facing page 760
Commercial Information 761
Classified Advertisements 43
Index to Advertisers 52

SUBSCRIPTION RATES

United Kingdom and Overseas £2. 10s. 0d. per annum. Canada $7.50, U.S.A. $7.50 per annum. Subscriptions are payable in advance and may commence with any issue throughout the year. Overseas subscriptions may be paid to The Electrical Times Limited by banker's draft, cheque or international money order. Single copies price 9d. each.

D

SCOTTISH EXPERIMENT

Little essential alteration was imposed on the Reorganisation (Scotland) Bill during its Committee stage proceedings last week. Indeed, the most notable of such changes as there were paradoxically took the form of an unexpected Scots present that electricity supply south of the border could well do without. This is the change from the robustly geographical British Electricity Authority to the "anonymous, bureaucratic, undescriptive" — to quote one M.P. — Central Electricity Authority as a title for the diminished successor to the present B.E.A. Where the debate was of especial interest, however, was in its suggestion that this may not be the last of the changes that will affect supply in the south. There was some measure of agreement between Government and Opposition that the proposed South of Scotland Board gives an opportunity for conducting an experiment in the common control of nationalised generation and distribution that needs to be made at some time, even if the B.E.A. remains undivided. An Opposition spokesman went so far as to say that the possibility of such a remarriage of the two intimately connected functions of electricity supply was actively in the minds of those responsible for framing the 1947 Electricity Act. What the Committee debate failed to reveal is the way in which the new Board is likely to handle its dual control. There was a resolute unwillingness on the part of the Government to anticipate the plans for the organisation of the South of Scotland district into two executives, which the new Board is required to draw up. But at least it seems that in return for the burden of an uninspiring name, the English and Welsh boards will benefit eventually by the results of yet another experiment in the reorganisation of electricity supply.

CABLE RATINGS INCREASED

For some twenty years now, ratings of paper insulated cables have been based on the classical investigation of the Electrical Research Association which resulted in E.R.A. report E/T128. It has been felt increasingly in the last few years that with present manufacturing techniques and materials, these ratings were too conservative, and with the approach of a revision of B.S.480 and the preparation of a new edition of the I.E.E. Wiring Regulations, much attention has been given to producing revised rating tables. Publication of such comprehensive tables, however, has been usefully anticipated by the Cable Makers' Association, which has issued rating factors applicable in general terms to existing tables. These factors, which are concerned with both paper and varnished cambric

cables, are based on permissible conductor temperatures 10° C higher than those used hitherto, and their effect is to give an increase in the permitted current carrying capacity of between 7 and 12% for voltages of 6·6 kV and below; a most welcome contribution to economy in electricity supply and installation practice. Two points about the new ratings deserve special attention. The new factors apply equally to aluminium sheathed cables, for which subsidiary rating factors were set out in the ELECTRICAL TIMES of 18th February, as to lead-sheathed cables. For the time being, however, they will not be directly applicable to installations in buildings which are being designed to comply with the I.E.E. Regulations. It seems likely that revision of cable ratings for this purpose will have to await publication of the 13th edition, when comprehensive changes are promised for all relevant classes of cable.

C.I.G.R.E. IN SESSION

The fifteenth session of the High Tension Conference which opened last week, will terminate on Saturday. Not until then will a full assessment of this biennial meeting be possible, but already certain varying accents within the familiar organisational framework can be noted. With nearly one hundred and thirty technical papers, the Conference maintains its reputation as the most highly concentrated technical meeting. A large British delegation is attending, with a representative selection of British papers of which that on the 275 kV supergrid is receiving particular attention. There appears to be a remarkable lack of controversy between the many national groups present, but a noteworthy feature is the increasing Japanese interest in the Conference; five papers are being presented from that country Surprisingly, one of these is the solitary paper to be discussed in the group concerned with d.c. transmission; what a contrast to the 1946 Conference when great things were expected of d.c. in the post-war world! Yet it would be wholly wrong to conclude that interest in this fascinating possibility is dead. We shall return to consideration of the Conference next week, and as in former years, our engineering staff are preparing an account of the discussions now taking place, with reference to the more important points of the papers presented.

TRANSATLANTIC BREAKERS

American circuit-breaker ratings are commonly more flattering than those of British equivalents, and the apparently fewer amps that the British breaker will interrupt is an embarrassing handicap when an attempt is made to sell in North America apparatus manufactured on this side of the Atlantic. There should be a ready welcome, then, for a tentative proposal for a modified U.S. standard for circuit-breakers which has been published as an American I.E.E. paper, and which recommends the use of symmetrical fault current as the basis of circuit-breaker rating, rather than the full assymetric current which is quoted under the present standard. At present the would-be user of an American circuit-breaker has to perform a series of calculations to find the rating he needs; if the present proposals are adopted, the same E/X value that applies in this country will tell him the rating he requires. Complications of d.c. component and fault power factor will be taken care of in the breaker proving tests. The new American system, which is not expected to apply for another two years or so, will still differ in minor details from B.S. 116 and, incidentally, from the appropriate I.E.C. standard: but in spite of this, and of uncertainties so far about the all important test code which will apply for proving the breakers, it does seem that the proposed standard will bring the two methods of rating conveniently nearer to each other, and will avoid many misunderstandings that have occurred with the present arrangements.

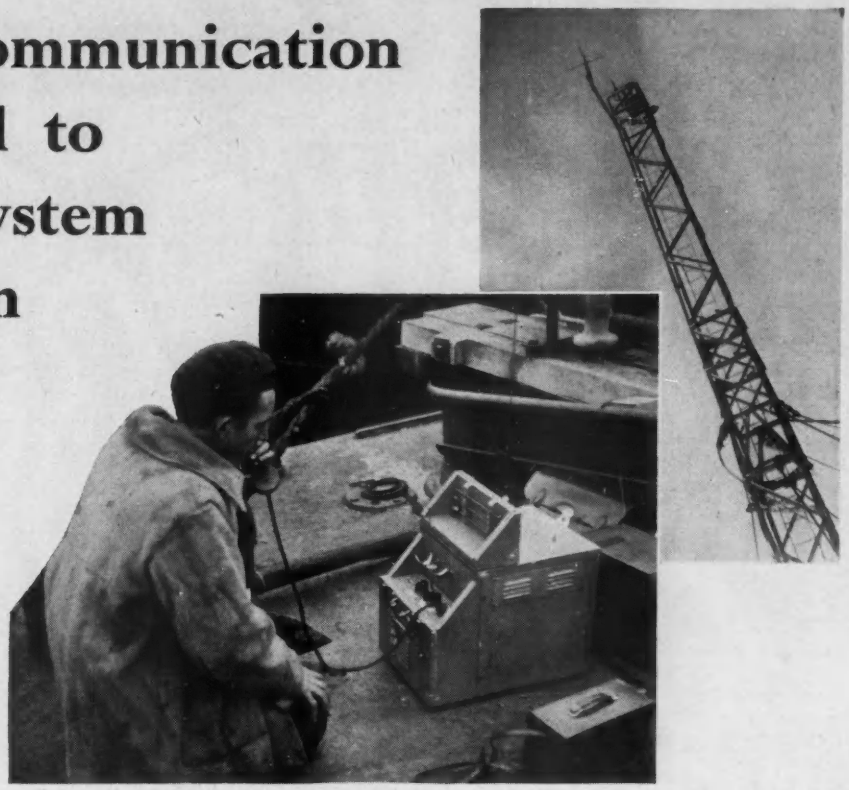
H.P. WIRING

Because electrical installations, properly planned and carried out, are so reliable, it is seldom that they provide a serious landlord-tenant problem. Yet when something does go wrong electrically in a low rental house, the situation becomes difficult indeed. Whatever the precise legal position, the likely result in all too many instances is that the tenant makes the best he can of the situation, probably with the aid of an amateur wireman friend; otherwise, if the trouble is of major significance, and the supply authority knows about it, he is faced with the dilemma of a large bill or disconnected supply. It was to meet such circumstances that a London local authorities' association suggested that the L.E.B. might undertake some form of assisted wiring schemes, whereby the tenant could pay for repairs in instalments. Attractive though this idea seems, it now appears certain that the Board will have to plead that familiar enemy of electrical progress, capital restrictions, as a reason for not tackling a new enterprise which seems acceptable to them in principle. This leaves the field open to the private enterprise contractor; although he is in a far less favourable position to undertake the organisation of hire purchase repairs and—is it too much to hope?—testing and maintenance with financial safety. Yet risky though such a venture could be, it might open the way to some worthwhile appliance sales, by way of compensation.

FIRES IN PREFABS

Testing and maintenance is certainly proving a necessity so far as the electrical installations in prefabricated houses erected immediately after the war are concerned. The Ministry of Housing and Local Government has felt it necessary to call attention once more to a recommendation that inspections of such installations should take place at intervals of 14 months or so. So far as the most recent published figures show, the chance of a fire is no greater than that relating to a pre-war conventional house: the worrying factor has been the more or less steady increase in the proportion of fires in such dwellings attributable to electrical apparatus and cabling. There is no doubt that the emphasis on frequent inspection is fully justified; but it may be usefully recalled that the Director of Fire Research has attributed this relatively high proportion of fires of electrical origin in temporary dwellings, at least in part, to a greater use of electricity in these than in other types of these than in most other types of building.

Radio Communication as an aid to Power System Operation



PART I

By R. E. MARTIN*
D.F.H., A.M.I.E.E.

THE increasing application of radio techniques and radio communication in the power industry, both in Britain and overseas, sometimes causes the power engineer, who is often more used to dealing with 50 c/s, some difficulty in appreciating certain of the special considerations governing the use of radio equipment.

The object of these articles is to outline some of the basic requirements for mobile radio schemes and fixed-to-fixed radio links. The former have, of course, become important in the construction, maintenance and consumer service fields whereas the latter are already established in some countries in meeting the protection relaying, telemetering and communication requirements of large interconnected networks.

Advantages

The many advantages of mobile radio telephony are now becoming widely appreciated, particularly for maintaining contact with breakdown gangs and linesmen in the field. [1, 2] This system is also being used for engineering work during switching operations, line construction, etc., where rapid telephonic contact between units in the field and a central control room may be vital in the interests of safety and efficiency.

It is difficult to assess the monetary value of such a service but experience in those electricity boards making full-scale installations shows that much time is saved, and in addition petrol and money are economised. As an example, taking another field, in the case of the ambulance service, it has been stated that a scheme with about 40 mobiles would cost £6,800 initially and £1,100 per annum for maintenance but the cost would be more than offset by the saving in time and petrol. How many breakdown crews and engineers in the electrical industry pass, unknown, close to the scene of trouble on their way back to headquarters, only to be told to return by the same route. The number cannot be estimated. This, among numerous other examples, is proof of the value of what is, essentially, nothing more than a telephone in a van or car.

At this point it is worth stressing that tests carried out without due consideration as to the proper siting of the headquarters station may often prove disappointing. An appreciable increase in coverage from a given station may be obtained by choosing the site from the point of view of propagation and not from ease of control, as has so often been the case in the past.

Typical Scheme

Mobile radio schemes are usually operated, in Britain, in the very high frequency bands, using commercial equipment of the types extensively employed by the police, fire and ambulance services. The frequency bands at present employed for commercial use are 70-90 Mc/s and 170-190 Mc/s and these have generally become known as the "low" and "high" bands respectively. At these frequencies atmospheric interference has little effect although man-made interference can be troublesome.

Frequencies of this order are propagated in virtually straight lines, although a certain amount of refraction does occur. Consequently the range of the equipment is restricted to some extent by the curvature of the earth and by physical barriers, such as mountain ranges, although communication is possible for a considerable distance beyond the optical horizon. In some ways this range restriction is advantageous as it reduces the possibility of interference between two adjacent but separate schemes when they share a common frequency.

A typical scheme, for example, could consist of one or more fixed station equipments which may be able to

*Mr Martin is with the B.E.A. Research Laboratories. 1. References are listed at the end of the article.

intercommunicate with a larger number of mobile stations. The mobile stations can also each intercommunicate with one another, either directly or, as will be described later, via the fixed station or stations.

The fixed station equipments may be controlled locally, or alternatively, remotely over a telephone line, by an operator such as a manual telephone switchboard operator. The latter facility is very helpful as it permits the radio station itself to be advantageously sited on a hill top and controlled over a 2-wire line from an existing office or control room.

Method of Modulation

As in all articles on the subject of v.h.f. radio it is necessary to deal with the two conflicting views as to whether the system should be designed for amplitude or frequency modulation. Much can be, and has been, said in support of both systems. Considerable experimental work has been carried out by many workers and organisations, including the B.E.A., to endeavour to determine which is the most advantageous method of modulation for a v.h.f. mobile service. Signal-to-noise ratios at a mobile station have been measured by the British Electricity Research Laboratories, using both systems, under carefully standardised conditions, both with heavy impulsive interference in urban areas and in open country.

The received radio-frequency field strengths in these experiments were adjusted to be equal, and a common aerial system was used at each end for both a.m. and f.m. Under conditions of heavy impulsive noise such as exists in some parts of London, it was found that the f.m. system offered an improvement of some 10-12 db in signal-to-noise power ratio. This improvement, however, was only apparent when the received field strength was reasonably high. The a.m. receiver was fitted with a standard type of noise limiter which was left in circuit during the tests. The average signal-to-noise ratios for a.m. fell with decreasing field strength at increasing distances from about 50 db to 18 db at five miles over a typical heavily built-up city path. It was not possible to draw a final conclusion as to the most advantageous system owing to the fundamental difference in the method of operation. However, a.m. equipment was preferred in general in view of its greater ease of maintenance and superior intelligibility at extreme ranges. The development of satisfactory noise-limiter circuits has done much to meet one of the earlier chief criticisms of a.m. For various reasons, including those stated above and by virtue of availability, it has become standard for B.E.A. equipment to be provided for amplitude modulation and no reason has yet been found to regret this decision.

Choice of Method

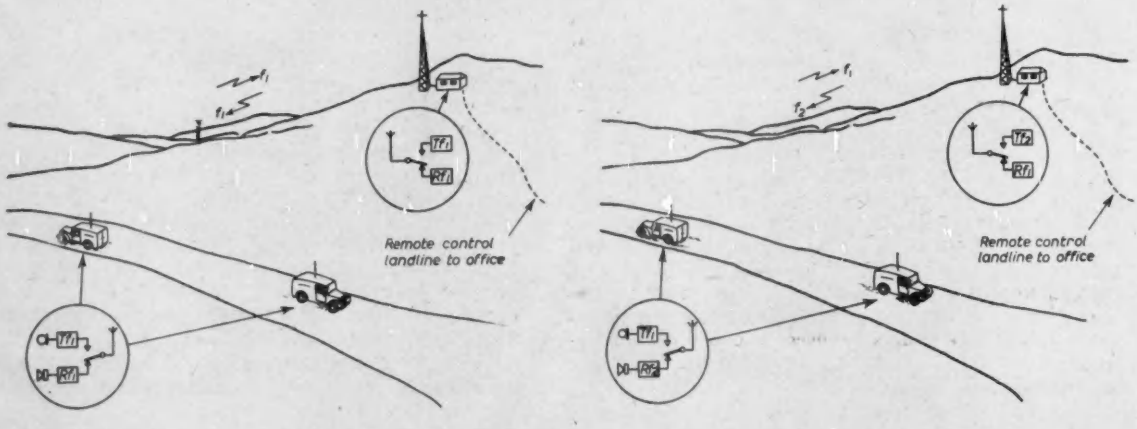
A basic single-frequency simplex system is shown diagrammatically in Fig. 1 where each equipment comprises a transmitter "T" with microphone, and a receiver "R" with telephone earpiece or loudspeaker. The transmitters and receivers are controlled in frequency by quartz crystals and are permanently tuned, without external adjustments being provided to vary the operating frequency "f_1."

All equipments are normally in the receive condition ready to accept any incoming transmission from another station. As the frequency is common to all units, each unit can hear all others and cars can intercommunicate without the fixed station being operative. But because the transmitter and receiver of a given station are working on a single frequency it is impossible to send and receive simultaneously. In other words the equipment is suitable for "simplex" operation.

In practice this has several advantages, amongst which are reduced power consumption at the mobile station and inability to "butt in" when receiving a message. The major disadvantage is the difficulty of coupling the simplex radio installation to a private telephone system where "duplex" facilities are, of course, already existing. There are some duplex mobile v.h.f. schemes in operation in which individual frequencies are used simultaneously for fixed-to-mobile and mobile-to-fixed but the system is not widely used today. One of the disadvantages of duplex working is the necessity of maintaining both transmitter and receiver in action simultaneously at the mobile end, where space and power considerations must be considered. In many simplex equipments the power unit is common to the transmitter and receiver but will not supply both simultaneously.

In practice it can be shown that it is advantageous to use simplex as described but using "two-frequency working." This is illustrated in Fig. 2 from which it will be seen that as the mobiles each send on frequency f_1 and receive on frequency f_2 they cannot, therefore, intercommunicate with one another but only with the fixed station. This is advantageous in some circumstances as it makes for good operating procedure in that all messages must be handled at the headquarters fixed station. It would appear at first sight that two-frequency working is uneconomical in the use of frequencies. But when viewing a country as a whole and considering all the various users and the availability of frequencies this is not the case. In view of the relatively close spacing of frequencies resulting from the large number of users in the v.h.f. bands it is most desirable to avoid interference between schemes which may be, not only on adjacent frequency channels, but physically

Figs. 1 and 2. Single-frequency and two-frequency simplex systems are shown left and right respectively



This unusual view of the River Thames at Barking was taken from the top of the south tower of the transmission line crossing the river. It illustrates the situation of the supply industry on both sides of the river with communication only conveniently conducted by radio

close as well. This applies particularly in large cities where fixed transmitters of one scheme may be operating close to the fixed receivers of another, and as a result unwanted interference may be produced.

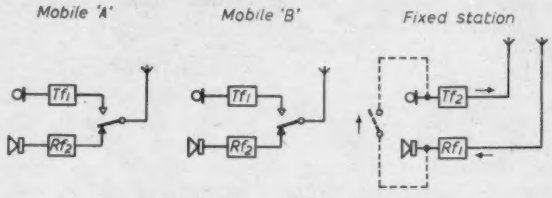


Fig. 3. Two-frequency simplex retransmission

It is, therefore, the practice of the G.P.O. to allocate the available frequencies in Britain on a two-frequency basis, except in special cases, thereby avoiding these forms of interference. To deal fully with this subject would require a separate article.[3]

British Electricity Radio

All electricity board channels are, therefore, allocated on a two-frequency working basis with a spacing of 10 Mc/s or more between the two frequencies. The mobile stations transmit on the lower frequency and the fixed stations reply on the higher frequency.

The fixed station receivers on the lower frequency are, therefore, 10 Mc/s or more away from fixed station transmitters which may belong to other schemes and be placed close to the receivers.

At the present time there are three two-frequency channels in the high band and two in the low band for the use of the electricity boards. The present arrangement is that these five channels are allocated on a repeating basis, usually to sub-areas, throughout the country. In the opinion of the author, greater freedom from interference would be obtained by allocating the five channels on an electricity board basis which would also allow interchangeability of equipment throughout a given electricity board. However, the allocation is arranged, insofar as is possible, to avoid interference by taking advantage of the presence of mountain ranges and the attenuation due to distance. The low band frequencies may give slightly better ranges due to the propagation difference and these are, therefore, allocated to the more hilly regions. There are at present about 43 fixed stations and 212 mobile stations in use by the electricity boards and this may be expected to increase to about 80 fixed stations and 650 mobile stations within the next few years.

The generating divisions of the B.E.A. in some cases require single-frequency working equipment as they may be using two or more mobile stations on line construction work in remote country regions out of range of their fixed stations. For such work as line-sagging, construction at road, rail and river crossings and so on, single-frequency working is desirable, although it is technically possible to have two-frequency working equipments with "reversed frequencies" in one mobile. The use of reversed-frequencies in one mobile is discouraged, however, in view of the departure from the standard two-frequency working plan which is designed purely from the interference prevention aspect.

At the present time there is a low-band single-frequency working channel for the divisions, which is common throughout the country, to allow intercommunication between personnel working on inter-divisional lines. There are about 20 fixed stations, 40 mobiles and 20 "walkie-talkies" in use by the divisions of the B.E.A. Certain B.E.A. colliers are also equipped to work divisional base stations on the standard frequency and one non-standard duplex installation exists which, however, can only be used at one station.

To make a comparison of the quantity of v.h.f. equipment in use in various countries by the power industry it has been stated in *Electrical World* (p. 131, 19th October, 1953) that in the U.S.A. at the end of 1942 there were 1,187 utility companies using 46,767 mobiles and 4,128 fixed stations. The petroleum pipeline industry alone had 17,140 mobiles and 3,508 fixed stations.

Retransmission

Turning again to Fig. 2 and the disadvantage of the inability of mobiles to communicate one with another directly, this can in some measure be overcome by the means shown in Fig. 3. The basic arrangement is exactly

as shown in Fig. 2 but a switch is added at the fixed station to enable the receiver output to be connected to the transmitter input, arrangements being made to operate both simultaneously. With the talk-through switch closed the transmission from mobile No. 1 on frequency f_1 is received at the fixed station, diverted through the switch and retransmitted on frequency f_2 by the fixed station transmitter. As all mobile receivers are tuned to frequency f_2 intercommunication between mobiles via the fixed station is now possible. This facility is under the control of the fixed station operator who can close the talk-through switch when required. This is often advantageous where the fixed station is not manned at night, when the switch can then be left closed enabling all mobiles to intercommunicate on a breakdown job without any personnel to operate the fixed station.

REFERENCES

1. E. W. Northrup: "Review of the Applications of V.H.F. Radio Communications," G.E.C. Journal, vol. XVI, No. 4, October 1949.
2. R. E. Martin: "Radio Communications for Power Systems," Paper 319, C.I.G.R.E. Paris, 1950.
3. H. A. Chapman: "The Single and Two Frequency Systems of V.H.F. Radio Communication," B.I.S.R.A. Restricted Report PE/B/20/50, April 1950.

Reorganisation in Scotland

WHEN the Electricity Reorganisation (Scotland) Bill passed through its committee stage in the House of Commons last Wednesday, the most striking change was, paradoxically, of primarily English and Welsh interest. This was the provision that the name of the "British Electricity Authority," as modified by the Bill, shall become "Central Electricity Authority." In accepting the proposal that the change be made, the Parliamentary Secretary to the Ministry of Fuel and Power stated that the B.E.A. "has no objection to the change of name."

Perhaps the most important change in the Bill as originally drafted has come in relation to conditions of employment and pension rights. An amendment moved by Mr A. M. F. Palmer, and accepted by the Government, provides that the British Electricity Authority (acting as well for the area boards), the North of Scotland Board and the new South of Scotland Board shall *jointly* consult with appropriate organisations concerning conditions of employment and the other matters specified in the 1947 Electricity Act. Thus the principle of national U.K. negotiations will be preserved: as the Bill stood originally, it had seemed that any of the three main authorities might conduct independent negotiations. Mr Palmer, who was thanked by the Government spokesman for his help in negotiating agreement on the amendment, emphasised that everyday discussions of wage rates, salary scales, etc., were not covered directly by the clause, which only related to the establishment of machinery for collective bargaining, and the recognition of trades unions.

Not all the discussions of amendments ended in such general agreement. There was criticism from the Opposition benches that the Bill does not, in fact, give the Secretary of State for Scotland control over that country's electricity supply since it does not curtail the Minister of Fuel's general duties of co-ordination: but the whole argument here ranged round just what is implied by "co-ordination." Then there was a demand for a specific requirement that one member of the South of Scotland Board should have had experience in the organisation of workers. This the Government spokesman resisted, on the grounds that there was no precedent for it in the 1943 North of Scotland Act nor in the 1947 Act, but he assured the Committee that the Government would have in mind "just such persons," and this undertaking was accepted.

The question of forming a South of Scotland Board occasioned varied views on the integration of electricity supply. Mr Palmer contended that no technical justification had been advanced for the changes proposed in the Bill and quoted at some length Mr T. G. N. Haldane who, he claimed, had written an article refuting in general terms the whole case for the Bill. Mr Palmer expressed himself in support of any decentralisation of distribution, but he opposed breaking up the central organisation for generation and transmission. He met with some disagreement from Mr A. Woodburn, former Secretary of State for Scotland, who quoted Sir Arnold Gridley's statement that "power stations should be under the control of those responsible for providing current to consumers in their territory" as evidence that experts disagreed. Mr Woodburn went on to say that so far as he could discover no other country divides generation from distribution. He stated that when the Labour Government nationalised electricity they "did not interfere with the well-established Grid system, but proceeded to add to it the new nationalised distribution scheme. Those in the Labour Government responsible for this step recognised that the time would come when we would have to consider whether these two things should be married into one system." He went on to say that he was authorised to state on their behalf, that even now they were not quite sure that the time had arrived for this; the formative period was not yet exhausted. He also stated that he thought that the price of electricity in Scotland might well be reduced in the short run as the result of the Bill, but be greater in the long run.

New Executives

The most obstinately argued period of the debate came with discussion of the requirement that the South of Scotland Board shall prepare a scheme for setting up executives in the east and west areas of the Board, and for delegating certain functions to such executives. There were many requests for explanations of this, but the Government spokesmen maintained that there could be no useful comment until the Board had produced the scheme. They suggested that the South of Scotland Board would be responsible for control, planning and financial policy over the whole area, but that the executives would handle such local problems; but they offered nothing more precise. At the end, the Opposition announced their intention to put down an amendment on the Report stage.

A matter of some importance to present supply industry employees is the arrangements for compensation where there is loss of employment or diminution of emoluments or pension rights. As the Bill stands, it appears that there might be an eight-year qualifying period of service, and some members felt that the period should be not more than seven years. It was finally agreed to leave this matter until regulations are made. Mr Palmer raised a query about pension rights specifically and the Government spokesman undertook to look into this question to make sure that no one was deprived of such rights.

The only other major change in the Bill is an amendment of that Section of the Local Government Act, 1948, dealing with payments by supply authorities in lieu of rates. These will now be calculated on a new formula for taking into account sales of units generated outside the authority concerned. The changes were characterised as rectifying something which was a little unfair to England.

Rapid Starting at Power Stations

Tests at Poole suggest that Significant Improvements are Possible in running up Turbines

IN operating large turbo-alternators, the ability to start the plant rapidly, especially after a comparatively short shut-down period, is of considerable importance. During the last two years, tests have been conducted at Poole power station which have shown that the equipment there, when run as a boiler-turbine unit, is particularly well suited to rapid starting after a shift shut-down, no special devices such as steam dumping being required. The tests mentioned, and the conclusions drawn from them, are described by Messrs J. S. Hale, B.SC., TECH., A.M.I.MECH.E. (Metropolitan Vickers Ltd.) and A. F. Brittin, B.SC. (Superheater Co.) in a paper which was presented to the Institution of Mechanical Engineers on Friday last.

Before noting the conclusions drawn from the tests, it is necessary to consider the plant on which they were conducted. Poole power station was described in the ELECTRICAL TIMES on 7th June, 1951. Two radiant type 300 klb/hr boilers feed steam at 950 lb/sq in., 950° F to each three-cylinder turbine rated at 50 MW m.c.r., 900 lb/sq in., 925° F at t.s.v., and 29 in. mercury vacuum. The boilers are arranged to operate on to a steam range.

Boiler Firing

Boilers are tangentially fired by pulverised fuel introduced from three burners in each corner of the furnace. Each ring of burners is supplied with coal from one 12-ton mill. Ignition is by means of oil burners. The p.f. burners may be elevated or depressed manually. The superheater consists of horizontal self-draining primary and secondary sections with non-contact desuperheaters between primary outlets and secondary inlet. The primary superheater has two stages, the first being constructed of mild steel and the second of 0·5% molybdenum steel. 0·5% molybdenum steel is also used for most of the secondary superheater, but the final leg is made of 1·0% chromium, 0·5% molybdenum steel.

The h.p. cylinder of the turbine has nine stages, the i.p. fourteen and the double flow l.p. cylinder, three stages. Critical speeds of both h.p. and i.p. rotors are higher than running speed. Steam glands at the rotor ends are provided by means of separate sleeves, shrunk on to the shaft, anchored at the outer ends and free to expand towards the centre of the rotors. The whole turbine is anchored at the generator end of the l.p. cylinder. Steam is supplied to the turbine through separate twin steam chests.

Tests were performed with two boilers feeding one turbine. For very low steam flows only one boiler was used, but in most tests, the steam temperatures and pressures of the two boilers were reasonably balanced by the time the turbo-alternator was synchronised. In all cases it was found that the steam demand during the period of synchronising and initial loading was too small to allow continuous coal firing on the boilers, even though the superheater circulating drain of 1¼ in. bore remained open throughout.

With the steam flow obtaining during the tests, no difficulty was experienced in providing a high steam temperature at the boiler stop valve at the completion of the pressure-raising period. In dealing with control of steam temperature, the heat inertia of the steam piping appears to be an important factor, and warrants careful attention in each individual layout.

Five main conclusions were drawn from the tests at Poole, and these may be considered in the order set out in the paper. The first and most important is that the rate of starting of the turbine need be limited in practice only by the rate at which the various starting operations can be performed, provided the steam temperature at outlet to the turbine steam chest can be maintained between the limits of 150° F above and 50° F below the temperature of the inlet casing. It is quite possible that steam temperatures more than 50° F below the temperature of the metal may be possible, but the data obtained suggests that cooling itself may promote vibration, apart from delaying the essential heating process. The pressure in the boiler is not important of itself.

The +150° F, −50° F limits on the inlet casing temperature may be increased, if necessary, by 50° F without undue risk of prolonging the start. If the upper limit is exceeded, however, vibration is likely to occur.

Under unit conditions, apart from a few minutes immediately after lighting up, the boilers were able to provide steam which reached the turbine at a temperature within the desired range, without recourse to steam dumping or other special measures. During the run-up, use was made of the intermediate desuperheater and the tilting feature of the burners. There was sufficient drop in steam temperature along the piping, at low flows, to make an important contribution to successful temperature control at the turbine inlet; but it appears that the boiler could have given this control without assistance from the steam piping. Finally, the quantity of auxiliary steam used during the unit starts was insufficient to have an appreciable effect on the steam temperature at the turbine, or to make a significant contribution to easing the problems of boiler control.

The test starts were made following shut-down periods of six hours, the time from admission of steam to full speed being 14 minutes, 20 minutes and 9 minutes, compared with 30 minutes on a typical range start. One start was made after a 2-hour shut-down, and took 8½ minutes, and two starts after a 12-hour shut-down, which took 30 minutes and 23 minutes from rolling to full speed against a typical 120 minutes for range starting.

DISCUSSION

The Paper was described by Mr W. WILDE, who opened the discussion, as embarking on a subject which was of outstanding economic importance in the running of the electricity supply system. The present night load of B.E.A. amounted to 5,500 MW and the day load was about 16,500 MW, so that the Authority had the problem of starting 11,000 MW of plant once or more on every day of the year. In a few years' time half this total would fall to be operated in the South-East of the country. The problem had been increased in recent years by the elimination of load shedding and the resultant increase of peak load relative to base load. The load factor on the national system was about 44%, compared with load factors of over 60% in the U.S.A., so that our starting and stopping programme was relatively one-third more acute than that in America.

Mr W. W. CAMPBELL said the results seemed to confirm that the machines could be started up rapidly for a limited number of times without causing excessive turbine vibration or excessive metal temperatures of the superheater, but he was not sure to what extent the paper proved that turbines could regularly be treated in this way without ill-effects.

Mr G. R. PETERSON said B.E.A. had set up a working party to investigate the subject. The rate of rise of load on the B.E.A. system was at times 120 MW a minute, but unfortunately the Paper did not give much information on loading, as distinct from starting. There was a reference to a rate of rise in the inlet-end-metal temperature of 850° F per hour, which was pretty severe.

Mr P. F. CARSON suggested that test results could be valid only when undertaken with one boiler and one turbine. His Company had just completed a series of tests in conjunction with the B.E.A. at Fulham Generating Station. From the data obtained in the tests techniques had been established by which after a five-hour shut-down, a 50 MW turbine had been supporting full load 33 minutes after first admitting steam. He agreed that the rate of starting need be limited only by the rate at which the various starting operations could be performed but suggested that the steam temperature at the inlet to the chest should, if possible be 150° F above the metal temperature of the casing inlet belt.

Mr J. EYERS said the rapid starting technique might result in substantial differences in temperature developing between the steam pipe material and the flanges.

MR J. H. R. NIXON considered that a discussion on rapid starting techniques could not be complete without a reference to the radial flow double-rotation type of steam turbine which had been developed in this country. The unique construction of this machine by-passed most of the turbine problems which were mentioned in the paper.

Mr F. L. DRANSFIELD stated that lack of adequate and detailed information of what the turbine-maker wanted was holding up the work of boiler designers. This was the first Paper published in England, although there had been a spate of Papers in America, and he had returned from a visit to America with the view that there was no great difficulty in quick starting from the boiler point of view. He emphasised, however, that the good results achieved at 900 lb/sq in., 900° F, might not be easy to repeat at a steam temperature of 1,000 lb/sq in., 1,050° F.

Dr R. J. ELDRED asked whether it was essential for a machine to be to full temperature before loading was started. In America a machine would be put on load in perhaps 20 minutes to half an hour, and it might be three hours or more later before the machine reached full temperature.

Mr J. BRUCE, in a contribution read for him, said the Authors had not mentioned the number of people required efficiently and safely to conduct the new starting technique, but he assumed that more were needed than would be available when the new methods became routine practice.

Mr G. H. HARFORD warned that in the future design of plant they faced conditions which were far more arduous than those at Poole. From time to time he had been impatient of the demands of the turbine manufacturer; there were plenty of ways of providing a control during lighting up, but it was a complication, and complication meant accountable costs.

MR O. S. WOOD said what was being sought was not a rapid starting of the turbine but a predictable time from boiler light up to turbine full load. The United States had been working on the problem for five or six years and now asserted that the problem of quick starting was simple: all you had to do was to arrange for the steam admitted to the turbine to be at temperature equal to, or slightly higher than, the temperature of the turbine steam chest.

Paper and V.C. Insulated Cables Uprated

ALLOWABLE maximum operating temperatures now in use for the calculation of current ratings for paper insulated and varnished cambric insulated mains cables have been established at their present level for approximately 20 years. It is proper that the basis of calculation should be subject to review from time to time, and the C.M.A. have recently been giving active consideration to the question.

As a result, the C.M.A. is able to recommend an increase of 10° C in the maximum working temperature for all such cables operating at voltages up to 6·6 kV inclusive. This increase will apply to existing cables as well as to new cables, and it will mean that the permissible conductor temperatures for cables installed in air or laid direct in the ground will now be 80° C instead of 70° C. In ducts unarmoured cables will be limited to a maximum of 60° C, but aluminium sheathed or armoured lead sheathed cables may operate at 80° C.

TABLE 1.—RATING FACTORS FOR CABLES UP TO 6·6 KV, APPLICABLE TO E.R.A. REPORT F/T128.

Type of Installation	Rating Factor
All cables laid direct in the ground Aluminium sheathed cables in ducts Armoured lead sheathed cables in ducts	1·07
All cables installed in air ... ... Unarmoured lead sheathed cables in ducts ...	1·09 1·12

The effect of this change in temperature limits will be to increase the present current ratings and, pending the issue of new tables of ratings, the factors shown in Table 1 may be applied with reasonable accuracy to the present values published in E.R.A. Report F/T128 for lead sheathed cables. For cables having either aluminium conductors or aluminium sheath or both, these factors should be taken in conjunction with the tables of correction factors recently issued by the C.M.A. This information was published in the ELECTRICAL TIMES, 18th February, 1954.

When the higher operating temperatures referred to above are employed the factors already published to take account of variations in ground or air temperature will also need modification and the values shown in Table 2.

TABLE 2.—RATING FACTORS FOR CABLES LAID DIRECT IN THE GROUND OR DRAWN INTO DUCTS, TO BE APPLIED TO VALUES GIVEN IN E.R.A. REPORT F/T128.

Soil or duct temperature °C	Rating factors for final conductor temperature of	
	60° C	80° C
20	0·94	0·96
23	0·91	0·94
25	0·88	0·92
27	0·86	0·90
30	0·82	0·88
32	0·79	0·86
35	0·74	0·83

TABLE 3.—RATING FACTORS FOR CABLES INSTALLED IN AIR, TO BE APPLIED TO VALUES GIVEN IN E.R.A. REPORT F/T128.

Air temperature °C	Rating factors for final conductor temperature of 80° C
30	0·95
32	0·93
35	0·90
40	0·84
45	0·79

In the case of 11 kV cables, other considerations have to be taken into account since the operating stresses are higher. The C.M.A. are giving further consideration to this matter.

notes on wiring

by Megohm

EVERYONE is familiar with the principles of the ring circuit and the 13A socket-outlet. This type of installation was evolved to enable the cost of wiring to be kept as low as possible and provide an adequate number of sockets in the average sized house.

Post War Building Study No. 11 describes the 13A socket ring circuit and its advantages, and sets out a recommended minimum number of sockets to each type of room. This section of Study 11 was compiled by a select body of engineers on whose recommendations the 13A socket-outlet, as we know it today, was evolved. The minimum number of sockets per room was set down as follows: living rooms, kitchens, and double bedrooms—3 sockets, and single bedrooms—2 sockets. From personal experience I agree that these numbers should be regarded as the bare minimum. Many architects, and others, look rather surprised when these numbers are quoted, but I feel certain that they would be the very people to complain if they had to contend with an inadequate number of sockets in their own homes.

It is therefore rather disturbing, in view of the recommendations which have been so carefully arrived at, to hear that there have been cases where only four 13A sockets have been installed in houses. My information came from a reliable source, but I was unable to ascertain whether the person (or persons) responsible was the architect or the housing authority. I understand that one reputable firm of manufacturers has the matter in mind and has tackled it in a mild way in the architectural press. I agree that it is difficult to educate architects in electrical matters, but surely if a guide is given in a document such as Study No. 11 then the recommendations should be noted.

What will happen, in cases where an inadequate number of sockets are installed is obvious and disturbing. The amateur wireman will be called in and the result may prove disastrous. I have seen examples of additions to existing ring circuits which were far from perfect.

Problems of Ring Circuits

It is rather surprising to many people to learn just what they cannot do when installing a ring circuit. Many of these errors are due, in my opinion, to the rather vague regulations governing ring circuits. It is quite interesting to discuss the relevant regulations with different people and obtain their views on the matter.

One contractor installed a ring circuit in a house and connected to this three 2-kilowatt panel fires (fixed type) each controlled by a spur box, fused. On 230 V this gave a total loading of approximately 27 amps which was thus 3 amps below the capacity of the ring circuit. Of course under Regulation No. 201D this arrangement is not permissible. This regulation states that the sum of the ratings of all fixed appliances fed from such a final subcircuit must not exceed 15 amps. The operative words in this case are "fixed appliances," because looking at this matter it would appear that the arrangement is satisfactory. The wiring is capable of carrying the full load and each appliance is protected by a fuse. I feel that this regulation could be revised in some way in order to allow such an arrangement to be installed. Most of the consumer unit type of switchgear contains at least two 30A fuseways, and I feel that many more people would consider fitting panel fires in their homes if such an economical arrangement was allowed.

Another problem which has come to my notice with regard to a 13A socket ring circuit is worthy of discussion. Certain contractors engaged on installations in flats have been instructed to install a socket in an odd corner away from the general run of the sockets and just to the rear of the main distribution gear. They have, therefore, run a spur to this position without intermediate fusing *from the terminals of the 30A fuse.* Objections have been made to this by inspectors, but no technical reason given for the objection. I cannot see anything wrong with this arrangement, and I cannot find anything against it in the regulations. The appliance is protected by the fuse in the plugtop, and the only thing which may seem wrong is that it is contrary to the spirit of the ring circuit.

All these problems tend to make it clear that the regulations governing ring circuits must be considered by the committee now working on the task of bringing the regulations up to date.

Unusual Installation

In these notes of 22nd April, 1954, I described what to me was an unusual installation which I had to inspect in Sussex. In this installation, the *neutrals* were looped at the switches. I never met this type of installation before and I went to some trouble to find out if any of my friends had. I discussed this matter with a number of contractors and they assured me that they had never seen an installation wired in this manner.

However, two readers, one in Devon and one in Essex, have written to me and pointed out that they had carried out such installations. Both these letters have been printed in "Readers' Views."

One of these two gentlemen expresses his surprise at my opposition to the system without going into the matter deeply. I would hasten to assure him that I have considered the matter quite a lot and the more I do so, the less I like the idea. I think most people will agree with me that whichever type of fixing is used to hold the cover, we have to contend with the person who simply *has* to look into a switch to see what makes it tick. I appreciate that if that person suffers injury, it is his or her own fault, but we who realise these dangers must do everything to avoid such accidents. Therefore I feel that the presence of a neutral at the switch positions is not desirable.

In the case of the installation I inspected, the premises were used as a School, and several cases of the pupils banging the switch covers as they passed by had been reported, as this caused short circuiting. The provision of insulated covers would have remedied this, but I must repeat that I do not favour this type of installation.

More Power from Niagara

ONTARIO HYDRO'S LARGEST PROJECT IN OPERATION

SOME three and a half years ago the first earth was removed in the preparatory work for the Sir Adam Beck-Niagara Generating Station No. 2 near Queenston. Today the first power from this gigantic project is flowing into Ontario Hydro's system. With an eventual capacity of 1,820,000 h.p. this scheme is a spectacular monument to Canadian engineering skill and initiative. This year it is expected that the first five 100,000 h.p. units of the first 12-unit phase will go into operation. Early in 1957 the completion of the 12-unit phase, together with the power developed by the turbine-generators at the pumped storage scheme will bring the output up to 1,428,000 h.p., and future plans envisage the installation of a further 4-100,000 h.p. sets to bring the final figure up to 1,820,000 h.p.

Hydraulic Works

Water is taken from the river at a point about two miles above the Niagara Falls. This location was selected as sufficient water would be available without turbulence, and troubles due to icing could be avoided. The first step was to build a 1,100 ft timber-crib cofferdam, and an earthen dyke 400 ft long enclosing some 14 acres of the Niagara waters. Before excavation for the structures could proceed it was necessary to place a grout cut-off "curtain" around the whole area to be dewatered. This was accomplished by diamond drilling some 1,200 holes, about 25 ft deep in the rock and pumping in a mixture of cement and water.

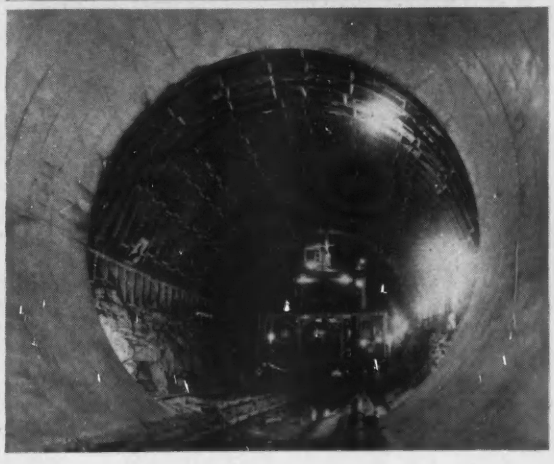
The intake structures resemble large mouth organs, and consist of a tapering rectangular compartment, with a series of "vanes" or roof supports along one side. The height of each intake tube varies from 29 ft (floor to ceiling) at the upstream end to 64 ft at the downstream end. The tube itself is about 500 ft long and will divert, through the gaps, some 20,000 cubic feet of water per second each from the Niagara River. Two tunnels convey the water some 5½ miles to an open canal which in turn carries it to the open forebay at the top of the cliffs above the power station site.

Tunnel No. 1 lining was completed in December 1953

This view shows the forebays of the two canals feeding the old station No. 1 (right) and the new No. 2 station. On the "island" between the canals is the site of the switch yard for the new station

Two miles upstream from Niagara Falls work is proceeding on the intake structures for the new Sir Adam Beck Niagara No. 2 development

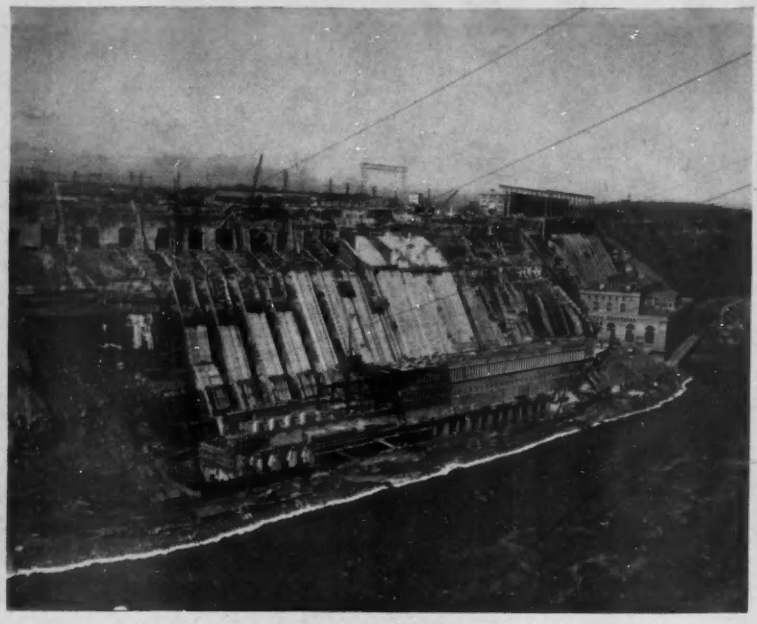
The inside of this 500 ft long concrete intake structure seen at the right directs a total of 20,000 c. ft of water per second from the Niagara River. This then passes into the 5½ mile long tunnels which in the picture (bottom right) are being lined with a 3 ft thickness of concrete by the diesel engined self-propelling hopper which running on rails receives the concrete from the surface through 10 in. drop holes drilled at intervals of 700 ft along the centre line of the tunnel



with the last 490,000 cubic yards of concrete placed. The finished diameter of the tunnel is about 45 ft. Excavation for No. 2 tunnel is finished and concreting well advanced. The twin tunnels run parallel and are some 250 ft apart centre to centre.

The job of removing over 3·6 million cubic yards of earth and 4·6 million cubic yards of rock for the canal and forebay is completed. On 6th March, 25 tons of explosives blasted out two huge rock plugs in the open-cut canal section. The first blast blew out the forebay plug—a 12,000 cubic yard wedge of solid rock separating the forebays of the new plant and the existing adjacent Sir Adam Beck-Niagara Generating Station No. 1. The second blast tore out the massive 34,500 cubic yard rock barrier at the lower end of the crossover between the existing and new open cut power canals.

One of the unique features of the huge project is the pumped-storage scheme authorised in July of last year. This involves the creation of a storage reservoir covering some 700 acres and containing 650 million cubic ft of water; the widening of a portion of the open-cut canal; enlargement of the forebay, and the extension of the headworks for the operation of the four additional units to be installed as required. A pumping plant, equipped with eight pump-turbine units will be located at the upper end of a 1,400 ft off-take canal, now being excavated. This scheme is scheduled for service in 1957, and will increase the generating capacity of the project by pumping water into the reservoir at night, and at peak periods

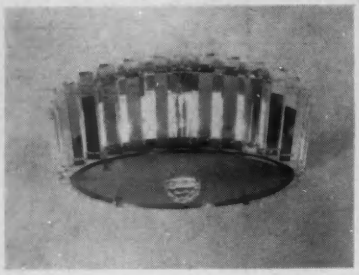


This impressive view of the new station under construction shows the huge penstocks which when completed are encased in concrete

allowing this water to run back through the pumping turbines—which will then act as generators with a capacity of 228,000 h.p., and subsequently through the main turbines.

At the foot of the two lane service road carved out of the face of the 300 ft cliffs of the Niagara gorge, is the power house. The steel penstocks, 19 ft in diameter and 492 ft long for the first six units have been installed and work on the remainder is well advanced. The power house itself, and the control building, which will eventually be the operational centre of both stations, Nos. 1 and 2, are both well advanced. In the first 12-unit stage, the power house will measure 930 ft in length, 63 ft wide and 50 ft high. The provision for the total of sixteen units will bring the overall length of the station to 1,150 ft.

Lighting in the Royal Yacht



Above, "Britannia" passing Henley's Cable factory at Woolwich and left, the G.E.C. "Coronet" fitting

THE return of Her Majesty Queen Elizabeth II to Great Britain has again focussed considerable attention onto the vessel, H.M. Yacht *Britannia* in which the final part of the journey was made. As would be expected in a vessel which was designed for economic conversion to a hospital ship in the event of war, electrical equipment on the *Britannia* is extensive ranging from five generators for supply, to electric cooking equipment and specially designed decorative lighting fittings.

When the Royal Party is on board, it is necessary to have steam on the boilers and therefore the three 500 kW steam turbo-generators supply the load. At sea, this is some 730 kW. For harbour use a 270 kW diesel alternator is employed, the load at present being some 250 kV. For emergency supplies one 60 kW diesel generator is installed. At a constant pressure of 225 V d.c., the installation is on the two-wire, two-conductor system with both poles insulated. Generators feed into a main switchboard in the generator room, distribution to sub-circuits being effected by d.p., c.b.

Although, following the latest Service practice, fluorescent lighting has been installed in messes, offices, workshops, galleys and bathrooms, lighting in the Royal and State apartments is generally by wall bracket and ceiling fittings, supplied by the General Electric Co. A certain number are special designs produced in collaboration with the decorative architects responsible for her interior decoration. One such unit is the circular ceiling fitting for the dining room and upper deck entrance, in which a sparkling coronet effect is given by cut-glass prisms enclosing the single lamp. A faceted glass ball is mounted at the centre of the circular gold bronze plate which forms its underside. Many of the motors used on the ship were supplied by Laurence, Scott and Electromotors whilst B.I.C.C. cables were used throughout.

Improved Arc Welding

NEW RESEARCH FACILITIES MADE AVAILABLE

A FEW weeks ago, newly designed research and development Laboratories of The Quasi-Arc Company Ltd. were formally opened by Mr J. S. Hutchison, chairman of the British Oxygen group of companies. These laboratories have been specially designed and equipped to do the research, development and quality control work which is essential for the production of metal arc welding electrodes to meet the very exacting demands of modern industry. The special facilities required for this work are provided by eight main laboratories, namely, electrode development, mechanical testing, physical testing, metallography and petrology, X-ray diffraction, chemical analysis, spectrographic analysis, and industrial X-ray.

In designing these laboratories, careful attention was given to the planning of a very comprehensive electrical installation. The contractors for the whole of the electrical installation work were Messrs Griersons Ltd. and the installation was planned by the electrical engineer of the works planning and construction department of the British Oxygen Co. Ltd.

A 415 V three-phase supply to the laboratories is given by main cables from the works' substation to a metalclad floor mounting fuse-switchboard. From this switchboard sub-mains of "Crompton" paper insulated cables feed distribution boards of the flush-mounting pattern. The wiring throughout the laboratories is "Crompton" rubber insulated cable in screwed conduit or "Walsall" underfloor metal ducts. In the laboratories, these ducts under parquet flooring provide power points for the equipment already installed with reserve points, for extensions and alterations, accessible by removing a section of flooring. Power wiring is on the ring-main system with 13-amp sockets. The ducts also carry the wiring for the low voltage signal services. The floor mounting fuse switchboard is an English Electric "Combination" unit, while the subsidiary flush-mounting boards are the same company's "Superform."

A d.c. 200 V supply is provided in all laboratories by a separate two-wire circuit fed from a Nevelin glass-bulb rectifier with a d.c. current output of 60 amperes. To provide for immediate availability of the d.c. supply the rectifier can be switched in from any one of the laboratories where d.c. is required. This arrangement avoids either keeping the rectifier on load througnout the working day or going specially to the switchroom when d.c. is required.

Most of the artificial lighting in the laboratories is provided by "Crompton" fittings and fluorescent tubes. The lighting fittings are of the type AT with "Perspex" reflectors, and one 5 ft 80 W tube. The fittings are arranged in lines throughout the laboratories, the wiring channels being joined together by special coupling pieces.

In the experimental arc welding laboratory Messrs Griersons Ltd. were responsible for the installation of the welding cables for a.c. single and double operator units, and also constructed the test welding bay instrument panels and control desk. From the desk arc-welding operations in the bays can be observed, together with voltmeter and ammeter readings. A heavy copper link system allows for changing welding supply connections to provide a range of currents; in two of the bays up to a maximum of 1200 A. Ammeters and voltmeters were supplied by Crompton Parkinson Ltd. Other work undertaken by the contractors included the installation of the wiring for the automatic oil-fired boilers and the safety interlocking wiring and devices for the darkroom and the X-ray chamber doors.

General view of the new Quasi-Arc Laboratories. In the right hand corner can be seen the test welding bay control desk

Britain's Fuel Future

N.C.B. Official reviews Prospects for the next Fifty Years

THE future of fuel supplies has been the subject of much discussion recently, but members of the I.E.E. Utilisation Section, attending a lecture last Thursday, found that there was still much to be said. The lecturer was Mr D. HICKS, M.SC., Director of Scientific Control to the National Coal Board, and he tackled his subject under four clear headings: the availability of primary fuels, their conversion to secondary fuels; sectors of use; and finally, the problem of the future.

In terms of coal equivalent, the world's production of primary fuels is increasing, especially in so far as oil, natural gas, and electricity generated from water power are concerned; yet Britain's output of primary fuels is lessening. On a world basis, it is interesting to note that solid fuels (coal and lignite) account for only half the world's primary fuel total. In the U.S.A. solid fuel accounted for only 40% of the total primary fuels; petroleum products were approaching 30%. This gives a tremendous flexibility to U.S. fuel supplies, which is in contrast to Great Britain's one fuel character. In Western Europe generally, a great increase in the use of oil is becoming apparent.

For the world as a whole it seems that there is at present an average use of primary fuels of 1 ton per head of population on a world wide basis. World population appears to be increasing by about 1¼% per year, and the output of primary fuels can just about keep pace with this. In the U.S.A., primary fuel usage is about 7 tons/head, in Russia perhaps 1·2 tons/head. Great Britain uses 4·8 to 5 tons/head against 2·2 to 2·3 for Europe generally.

Turning to secondary fuels, there has been a striking increase in the use of both gas and electricity but this is a change in the form of fuel usage rather than in the amount of fuel used. In considering the pattern of consumption of fuel in this country, it is important not to dismiss domestic and transport uses as being unimportant for they add up to 40% of all primary fuel demands.

The domestic use of electricity and gas has increased greatly but the coal equivalent proportion used in the domestic market is about the same as before the war: one-third of the coal output comes to the domestic market. The railways have consumed between 13 and 15 million tons of coal per year since 1900.

Industry generally offers a big field for fuel economy, but it must be borne in mind that industry is widely spread. Savings can only be expected if enough engineers are trained to keep a continual watch on fuel economy, and enough money is spent on new plant and equipment.

Turning finally to the future availability of fuels, Mr Hicks stated firmly that there is an increasing gap between supply and demand which primary fuel producers cannot meet. For the next 50 years, coal must remain the main source of energy in this country, but it will worsen in type, quality, price and size. It is becoming increasingly difficult already to meet the demand for high grade coal, and the whole trend of mining engineering is towards the production of smaller coals. In particular, generating stations must expect coal with more chlorine, sulphur and trace elements. So far as price is concerned, there seems no chance of a significant decrease during the next 15 years.

The main hope of an easing of the fuel supply position comes, of course, from a consideration of nuclear energy. It is interesting, Mr Hicks considers, to note how optimism has increased on this account during the last twelve months, with confident estimates of success being achieved within the next 15 years. It seems dangerous, however, to assume that every difficulty will be overcome quickly. From these considerations, it seems that the main problem for the N.C.B. is how to bridge the gap of the next relatively few years. One other factor needs to be kept in mind. The fuel cell is a long shot, but it could have most important effects if success were achieved. What is needed, however, is fundamental work on the processes at the electrodes.

Understanding from Measurements

CONSIDERING engineering science from a philosophical viewpoint, understanding, as distinct from knowledge, can be regarded as the attitude an engineer develops towards knowledge on which his critical judgment has been exercised. Such knowledge is thus transformed to a state in which the engineer is able to invest his faith in it, and, in the engineering sciences particularly, this faith stems from measurements. As a factor in understanding, therefore, measurements play an important role and it was this aspect of measurements which Dr K. J. R. Wilkinson, D.SC., M.I.E.E., considered when giving the Annual Lecture to the I.E.E. Measurements Section last week. In the broad sense, measurements are taken to be controlled experiment isolating and revealing the mechanisms or forces to which the knowledge relates. Understanding thus develops as the concept in question is seen to agree with experiment and fit in with related concepts.

Whilst knowledge alone is a formal quality, understanding develops personality by virtue of the faith of which it is part. However, faith in knowledge can result in fallacious understanding, as exemplified by the belief that the earth was flat. Clarity in understanding by itself is a doubtful attribute, as shown by the schoolboy whose understanding of radio may be much clearer than that at later years when his critical faculty is more strongly developed. Effective understanding of any depth, because of the accurate knowledge on which it must depend, is, therefore, usually restricted to a limited range, often to those fields in which the engineer specialises. But on this basis, understanding rather than knowledge makes for a man's effectiveness as an engineer.

Electrical engineering, because it involves abstract concepts (such as motional e.m.f.), is a useful field in which to observe the difference between knowledge and understanding. For this reason no understanding is possible unless it includes an experience (preferably first hand) of critical measurement. But although measurement is an indispensable factor, it is by no means the only factor, as shown by the present knowledge of atmospheric electricity, which, acquired almost entirely by measurement, has not yet resulted in understanding in this field. Measurements are only effective when they are carefully considered and the evidence they present is properly sifted, a mental appreciation which is best effected by mental effort or personal ingenuity.

The supporting framework of this type ME compact source h.p. mercury discharge lamp used in mining has to be carefully spot-welded to give a robust assembly inside the glass envelope

The Production of High Quality Discharge Lamps

IT has been generally recognised for several years that improvements in electric discharge light sources result not from the discovery of new sources or materials but from continued research and development devoted to detailed improvements in existing lamps. What this means in practice was indicated last week in a visit to the Melton Road, Leicester, lamp works of the British Thomson-Houston Co., Ltd., where all "Mazda" discharge lamps, together with miniature and battery filament lamps are produced. Developments in both lamp materials and production techniques, the result of continuous work by research and manufacturing staff over the last few years, have led to considerable improvements in the performance of mercury and sodium discharge lamps. Since 1939, the life of this type of lamp has been nearly doubled whilst improvements to the phosphors of fluorescent lamps have resulted in an increase approaching two to one in efficiency quite apart from better quality colours.

Of the country's total annual production of 10 million discharge lamps, somewhat more than a quarter come from the Leicester works. Most of this output is in the form of mercury vapour discharge lamps, ranging from ultra high pressure pulsed lamps used for photographic or medicinal purposes to the now commonplace fluorescent tube. Of the types manufactured, two particular lamps—type MA, medium pressure, and type MB, high pressure—both of which are widely used for street lighting and industrial applications indicate production technique involved. Despite the introduction of machinery in many of the processes involved, a high proportion of skilled work by hand is still required.

In the production of type MA lamps, of which the more common sizes are 250 and 400 W, both main electrodes are hand fabricated. They comprise two close wound coils of tungsten wire, one locked inside the other and the inner holding an emissive pellet which maintains the arc on starting, until the vapour pressure has built up to the required value of about one atmosphere. Together with the wire rod starting electrode they are also sealed into the arc tube by hand, the glass of the seals having a coefficient of expansion similar to that of molybdenum to ensure a permanent seal. Exhaustion of the arc tube is mechanised in a special multi-process machine (manufactured, as are many others, by the company at Leicester), successive exhaustions and discharges ensuring the removal of impurities from the materials.

The type MB lamp, which made in 20 and 125 W sizes operates at a higher temperature and pressure requires an arc tube of quartz. The high fusion point and low coefficient of expansion of this crystal, however, preclude the use of normal sealing in processes and a molybdenum foil less than 0·001 in. is employed for the quartz-metal seal. A composite lead wire is sleeved in quartz on a special machine which heats the quartz to 2,000°C. This temperature is again necessary for sealing in lead in wires and electrode assembly, thus requiring

Samples taken from the production line of fluorescent lamps are seen here being checked for light output, the integrator normally being totally enclosed

Left, is a view of the machine on which type MA lamps are exhausted, injected with argon and sealed, intermediate processes including arc striking to liberate impurities and baking. Right, the ageing racks for type MA lamps, on which their characteristics are stabilised

the operation to be performed in a chemically inert atmosphere to protect the electrode.

The production of low pressure mercury discharge fluorescent tubes was observed from its start with the cleaning of tubes received from the B.T.H. glass works at Chesterfield to the inspection and packaging of the finished product. Prominent among recent developments on this lamp is the introduction of two new colours "de luxe warm white" and "new warm white." The latter, with an efficiency of 52 lumens/W is one of the highest efficiency lamps now available in this country. Coating is effected by a welling-up process, subsequent baking removing the intro-cellulose in which the phosphor is suspended. After a quality inspection, they are taken to the multi-process machine for completion.

To complete the picture is the production of sodium discharge lamps, recent developments in which were described in an article in last week's ELECTRICAL TIMES. Made in 45, 60, 85 and 140 W sizes, and gaining extensive use in street-lighting, the type So/H sodium lamp uses a special "hard" glass for its arc tube. It is of two-ply construction, the inner tube being a special glass resistant to sodium attack yet having the same coefficient of expansion as the outer tube. A feature of the sodium lamp is the "U" shape of the arc-tube, this 180° bend now being made by a recently developed machine. The portion to be bent is heated until it begins to flow under its own weight, at which instant each end is lifted through 90°. The semi-molten portion is then enclosed in a mould, compressed air pushing out the centre section to its shape.

Compatible Systems for Colour TV

ALTHOUGH intensive research on colour Television is being undertaken by many organisations, it is as yet too early to estimate the systems which will be adopted for general transmission in this country. A demonstration last week, however, staged by Marconi's Wireless Telegraph Co., Ltd., indicated some of the systems which are available together with equipment developed by the Marconi Company for such transmissions. All systems had one feature in common, that of compatibility, which enables colour pictures to be received and displayed as a black and white picture on ordinary television sets, whilst, conversely a colour TV receiver is able to receive monochrome transmissions and render them as such.

Basically, colour television involves the transmission of three primary colours, red, green and blue, each having associated synchronising pulses. In the simplest form, the three colours may be transmitted separately but as this requires a bandwidth three times as great, and ether space is severely limited, this method has been modified by compressing the colour information. The American system, recommended by the National Television Standards Committee (N.T.S.C.), involves both "band saving" and "band sharing." The former utilises the inability of the eye to discriminate colours in fine detail, thus enabling the bandwidth of colour components to be reduced. Band sharing involves fitting the reduced definition colour system into the high definition monochrome component, the complete system having an overall bandwidth of only 5 mc/s. Although this is a notable achievement, the saving in bandwidth is made at the expense of interference between the monochrome and colour components which is noticeable on a monochrome picture, this being shown in the demonstration of the N.T.S.C. system adapted to the British 405 line basis.

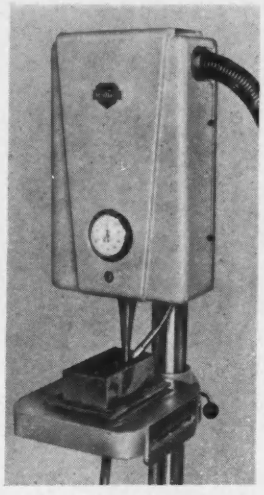
However, the Television Advisory Committee stated that it may be permissible for television in bands 4 and 5 to employ a 7½ mc/s bandwidth and, accordingly, Marconi are developing a "Wide Band" system which, having this bandwidth, involves only "band saving," with a corresponding increase in quality of both monochrome and colour pictures.

Equipment being demonstrated comprised an experimental two-tube colour camera developed by the Company, which gives high definition monochrome signals and low definition colour signals. Apart from being only a little larger than present-day monochrome cameras, the new camera has distinct advantages over the two other types of colour camera—three-tube type or single-tube type with either colour filter discs or fine pitch colour grid—in both cost and ancillary equipment requirements. Colour pictures were displayed on four screens, two R.C.A. tri-colour tubes and two projection displays made up from modified Philips-Schmidt projector tubes. Although the former gave a slightly better colour quality and higher general performance, they cost, at present, some £80-£100 each whilst the three tubes in the projection display cost only some £5 each, but require additional optical aligning equipment to ensure that colour images are accurately positioned.

The Ultrasonic Drill

An Instrument for Working Brittle Materials

THE accurate machining of hard and brittle materials, such as glass ceramics, germanium, tungsten and titanium carbides, diamonds and synthetic gems, has in recent years been facilitated by the application of ultrasonic techniques. These have now reached a stage where the Equipment division of Mullard Ltd. can make available to industry a 50 W ultrasonic drill (E7680) and is carrying out trials with a large 250 W unit, E7690. With the attachment of suitable tools, both these machines can, in addition to drilling, be used for such normal operations as cutting, shaping, hobbing, grinding, polishing, etc. Moreover, as these machine tools depend on a reciprocating as opposed to the more conventional rotary action, they are not limited to the cutting of circular holes but can accommodate intricately shaped holes which may be difficult, or impossible, to machine by ordinary methods.



General view of the ultrasonic drill set up for use

Choice of Machines

The 50 W drill is designed for bench mounting and is capable of machining holes varying from 0·006 to ½ in. across to a maximum depth of ¼ in. If greater depths than this are required special stubs must be used. On the other hand the 250 W unit is a fully-engineered tool and is suitable for mounting either on existing machine tools such as vertical milling machines, jig grinders and so on, or on a standard pillar-type drill stand. It can machine holes from 0·006 in. across to a maximum depth of 2 in. The drill head incorporates its own vertical slides which are made to a high degree of precision, and a pneumatic drill feed is incorporated to permit accurate control of cutting. Provision is made for the automatic retraction of the drill at intervals, thus enabling deep holes to be flushed out with fresh slurry and the cutting depth is continuously registered on a micrometer gauge recessed into the head. For automatic operation, the use of a slurry pump is essention, but if the machine is intended for manual operation the slurry can be hand fed. This slurry depends on the material to be worked, and is a suspension of silicon carbide or boron carbide in water. Normally the tool is made of brass and mild steel.

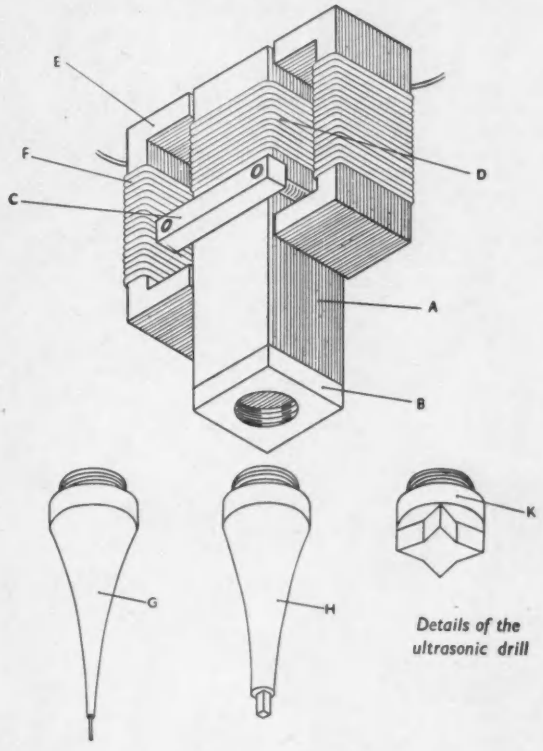
Machining accuracy and surface finish are naturally dependent on the size of the abrasive particles used. Surface finishes of 8 to 10 micro-inches are, however, easily obtainable, and finer finishes can be obtained if necessary. Using 120-mesh abrasive, a dimensional accuracy of 0·002 to 0·003 in. can be obtained on a roughing cut, and with a finishing cut using 1000 mesh abrasive it is possible to work to about 0·0005 in. Speeds of working depend, of course, on the size of tool and the hardness of the material. Using the 50 W drill, a ¼ in. square hollow tool will penetrate to a depth of 1 mm in 30 sec. A similar penetration into tungsten carbide would take about 10 minutes.

Technical Features

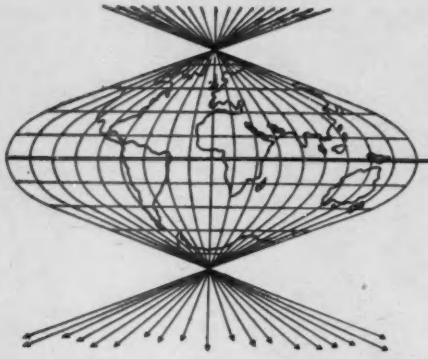
In the 50 W model, two units are required, the drill head and the ultrasonic power unit connected to the former by a single 4-core cable. The head itself consists of a magnetostrictive transducer coupled to a brass velocity transformer, or matching stub, to the end of which are screwed the various cutting tools. Three of these transformers are provided. The transducer is a 20 kc/s half-wave resonant section clamped at its nodal point. The drive coil is mounted on the transducer and separate polarising coils are fitted on a laminated yoke which flanks the transducer. The brass stubs are also 20 kc/s half-wave resonant sections, and magnify the amplitude of vibration at the drive end from 0·0005 in. to 0·0001 in, 0·0015 in and 0·003 in. depending on which of the three stubs is used.

In the 250 W version, a compressed air supply of 60 lb/sq in. and with a flow of 7 cu ft/min. is required.

In the sketch below, A is the laminated transducer; B, tapped steel tool holder; C, clamped node; D, energising coil; E, high permeability laminations; F, polarising flux winding; G and H, taper stub transformers with tool tips; and K, a heavy tip without transformer



Details of the ultrasonic drill



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Progress on B.C. Project

Engineers have completed the breakthrough in the final few feet of the 3,800 ft tunnel leading to the Spillimacheen hydro-electric project of the British Columbia Power Commission. The tunnel is now to be lined for its entire length. Seven ft in diameter, the tunnel will carry water from a diversion dam to a penstock which will drop about 165 ft to the power house to be built this summer. Operating head of the 5,500 h.p. plant will be about 210 ft. Water will drive three generating units—a new 3,000 h.p. set being supplied by the English Electric Co. of Canada Ltd., and two 1,250 h.p. units transferred from the dismantled Barriere hydro-electric station north of Kamloops. The new project is situated on the Spillimacheen River in the upper Columbia Valley. Power will be fed into a 33 kV transmission system probably early next year. Estimated cost of the station is put at $2 millions plus $425,000 for the transmission line.

Unethical Practices

The electrical appliance field in Canada is being undermined by the unethical practices of some dealers, it was stated at the annual convention of the Canadian Association of Radio, T.V., and Appliance Dealers, in Toronto earlier this month. Practices to which reference was made included the advertising of 1- and 2-year-old list prices as a comparison with dealer's selling price, baiting the customers by advertising an item at a low price and then pushing higher priced merchandise, and cutting profits to a point that threatened business. One speaker declared that a return to price maintenance, now banned by law, was needed to end the practice of "loss leader" selling. In the latter practice an advertised appliance was offered at almost cost price, and purchasers influenced to buy additional goods.

Remote Control

To reduce operating costs, the Orilla Water, Light and Power Commission, Ontario, is to install remote control equipment at its Minden power plant, at a cost of $45,509. The Commission decided to purchase the equipment for the Minden plant from Rogers' Majestic under a contract in which the Commission has the right to withhold 10% of the purchase price for one year. The contract specifies that if control is not satisfactory all mechanism is to be removed at no cost to the Commission. The latter's Mathias power plant has been operated by a remote control system since it was opened in 1950, but Mr S. Walkinshaw, general manager, has said he was not entirely satisfied with the operation of the equipment which was installed by another concern.

BRAZIL

Paulo Afonso Prospects

With the installation of the first two 60 M generators at the Paulo Afonso power project, in Brazil, it is now being proposed that a third similar machine should be added immediately to assist in alleviating the local power shortage. The problem of finance has arisen, however. So far the project has cost over Cr.1,000 millions in addition to a loan of U.S.$15 millions from the International Bank for Reconstruction. The outlay involved will greatly exceed the original estimates, it seems, and further funds will be required to complete the project. With this in mind, the Companina Hydro-Electrica de Sao Francisco, which is in charge of operations, has submitted a report to the President on the progress to date and the outlook for ultimate completion. It has been estimated that the plant could be expanded to 900 MW. The plant is located at the Paulo Afonso Falls, 180 miles from the mouth of the Sao Francisco River.

PORTUGAL

Steam Power Wanted

With the object of promoting the building and operation of a new coal-burning power station near the Peijao coalfields in the Douro basin, a new company with the title Empresa Thermoelectrínâ Portuguesa has been set up in Portugal. It is proposed that the station will have an output of 250 million units annually. Its cost is estimated at 180 million escados. We understand that the new company is to operate from Palacio do Comerino, Rua do Bokhao 72, Oporto. Apparently it is now agreed in Portugal that there must be sufficient reserve of thermal power to tide the country over periods of severe drought.

AFRICA

Escom's Good Outlook

This year is likely to be an important one for the Electricity Supply Commission of South Africa. It is expected that two new power stations will be put into commission. They are the Wilge station, near Witbank, and the Taaibos station, near Coalbrook in the Orange Free State. The Vierfontein, near Klerksdorp, which came into operation last year, is also being extended, and additional generators there are expected to be in commission this year. For the Wilge station, the first section will comprise two 30 MW generators and four 150 klb/hr boilers. For the Taaibos station orders have been placed for seven 60 MW sets and seven 580 klb/hr boilers.

Kafue Revised

A more detailed survey of water availability and storage for the Kafue hydro-electric scheme has shown that the minimum firm continuous supply of water will permit constant power generation of 375 MW at 80% load factor. This is nearly 120 MW more than was estimated in the project report of January 1953. This information has been revealed by Mr R. A. Nicholson, financial secretary to the Northern Rhodesian Government, and chairman of the Kafue Hydro-Electric Authority. The new figure allows for the use of the storage area immediately above the present proposed dam, but does not include any additional water storage capacity farther up the river, also now being investigated.

S.W. ASIA

Rajasthan Plans

Further information has now been received on the agreement to provide for augmenting the power generating facilities in Rajasthan, to which we referred on 29 April. In all, 19 thermal power stations are to be renovated and augmented. Plant and equipment to be supplied, under the Indo-U.S. Technical Co-operation Programme, includes 11 turbo-alternators, with boilers (two of 750 kW, six of 1,000 kW, two of 3,000 kW and one 5,000 kW), two 50 kW and one 100 kW alternators, and nine diesel generating sets (two of 60 kW, one of 100 kW, one of 150 kW, two of 200 kW and three of 250 kW).

Power Tax in Mysore

The Mysore Legislative Assembly has passed the Mysore Electricity (Taxation on Consumption) Amendment Bill, 1954, which aims at raising the tax on the consumption of electricity from two pies to four pies per rupee. It was said that there was ample provision in the Bill to reduce or exempt any deserving industry from surcharge. A revenue of Rs 12 lakh is anticipated with the passage of the Bill to make up part of the deficit of the State budget.

AUSTRALIA

Victoria's Surplus

From operations in the first nine months of the present financial year the State Electricity Commission of Victoria has made a working profit of £1,526,000, it has been stated. Revenue for the nine months totalled £17,273,000. The Commission received £16,273,000 from the sales of electricity; £596,000 from briquette sales; £361,000 from brown coal; £136,000 from provincial tramway systems, and £7,000 miscellaneous.

Tully Falls

It is expected that the first and major phase of the Tully Falls hydro-electric project, Queensland, would be completed by the end of this year. A large consignment of the piping for the project recently arrived by sea at Cairns. A spokesman for the contracting company said the project entailed construction of one and a quarter miles of tunnelling, a weir, a water intake and vent, and an underground power house, an estimated cost of £1¼ millions.

Queensland's Outlook

With a new 30 MW generating set and additional boilers installed at the Bulimba "B" power station of the Southern Electricity Authority, Queensland, and a second set expected in commission before mid-winter, it is likely that no electricity restrictions will be imposed in South Eastern Queensland this winter, the Minister for Mines, Mr Riordan, has announced. The Minister has also approved the issue of a licence authorising the Authority to extend its electricity supply to the Woodridge, Capalaba, and Kuraby districts, which are now included in the Brisbane City Council's supply area.

A Pumping Problem

The Sydney, N.S.W., Water Board has rejected an electricity scheme for its Ryde pumping station in favour of replacing the existing low pressure steam plant at a cost of £1,300,000. Mr Nichol, the chief engineer, had recommended gradually changing the whole station to electrical operation, and this view was urged by Sydney County Council and the N.S.W. State Electricity Commission, but fear of electricity interruptions and the belief that steam would be more reliable at Ryde influenced the Board members' decision.

NEW ZEALAND

Power Across the Strait?

The integration of electricity supply in New Zealand's North and South Islands was advocated by Mr C. J. Lovegrove, president of the N.Z. Electrical Supply Authorities Association, recently. If geothermal generation in the centre of the North Island proved a success there could easily be a two-way traffic between the two islands, Mr Lovegrove maintained. By this he meant that a temporary shortage in the South Island could be eased by power from the North Island, and vice versa. No one knew the production capacity of geothermal generation in New Zealand, he added. It was the cheapest form of generation yet known. It might be of considerable profit to the country to use the cheapest source of supply. That was one of the reasons why he was keen on the integration of power. The "little ditch" between the two islands made no difference. They had to think as New Zealanders. Surely if Britain and France could integrate power then the two islands of New Zealand could do the same, he declared.

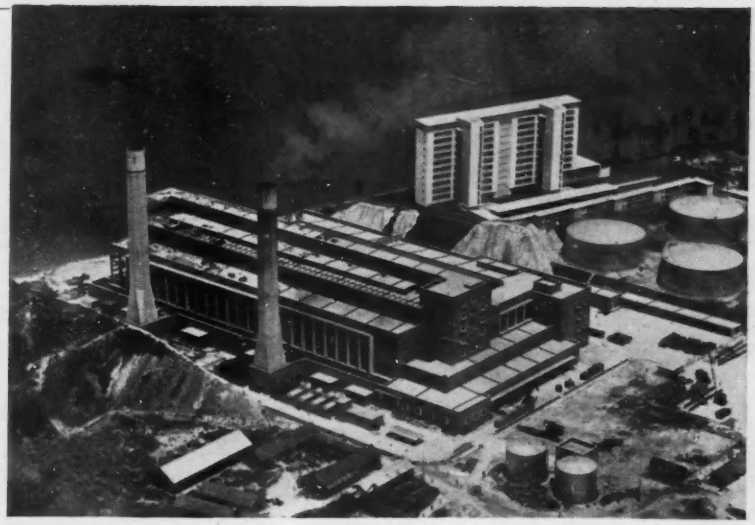
Good Results at Auckland

In spite of a temporary falling off in the demand from electric traction in the city, the Auckland Electric Power Board, N.2, reports an increase of 14·99% in units sold during the year ended 31 Dec. last. Units sold in the period amounted to 510·7 millions, of which 280·3 millions were for domestic supply (an increase of 17·64%) and 182·4 millions for commercial power (an increase of 14·0%), according to the interim figures just released. Mr N. M. Speer, general manager, has said that the estimated deficit of £74,000 for the year should be reduced by £30,000 to £40,000 when the final figures were available.

KOREA

Need of S. Korea

As an essential part of the plan to place South Korea on its feet again the electricity supply system must be rapidly augmented, it is realised. Present capacity is stated to be 80,000 kW, which is not enough to light the country's homes, apparently, far less to provide power for its factories. The United States planners want to increase the output to 450,000 kW within three years by importing plant costing about £17 millions. South Korea at first wanted a long-range hydro-electric power programme to be given priority, but later withdrew that demand and agreed to the U.S. proposal that three steam plants be built before any hydro-electric scheme is begun. The sites of the three steam stations are to be at Masan, Samchok and on the outskirts of Seoul. These plants, expected to be completed in two years, will cost £8,700,000, and have a combined capacity of 120,000 kW. But it is estimated that South Korea requires about 450,000 kW.



Rapidity of construction has been an outstanding feature of the Pasir Panjang power station of the Singapore City Council, shown alongside. Although the contractors only moved on to the site in January 1951, the first 25 MW Metropolitan-Vickers turbo-alternator and one 187·5 klb/hr Babcock and Wilcox boiler were in commission in December 1952. The plant at present installed consists of two 25 MW turbo-alternators and four oil-fired boilers steaming at 650 lb/sq in., 825° F. Mr C. C. Payne, city electrical engineer, tells us that work has now commenced on the erection of No. 3 turbo-alternator and No. 5 boiler, both of which are scheduled for commissioning by the end of this year. Work on the main building and jetty for fuel unloading is nearing completion. Ultimate capacity of the plant will be six 25 MW sets and nine 187·5 klb/hr boilers. In addition to the main station plant a gas turbo-alternator is on order from C. A. Parsons and Co. Ltd. This has a nominal rating of 1·5 MW but may run up to 2 MW if site conditions prove favourable. Incidentally, the impressive building seen in the right hand corner of our photograph, houses staff of the Singapore Electricity Department

Personalities IN THE INDUSTRY

Station chemist at Dunston power station, **Mr W. F. Stones,** A.R.I.C., has been appointed divisional chemist to the North Eastern Division of the B.E.A., with effect from 1 June, in succession to **Mr W. S. Coates,** who retires early next month.

Mr E. G. Batt has been appointed a director of Marco Refrigerators Ltd. Mr Batt retired at the end of March from the position of director and secretary of the British Refrigeration Association which he had held for seven years, prior to which he was independent chairman of the Association. He still acts in a consultative capacity to the B.R.A.

Mr E. H. Boyce, A.M.I.E.E., has been promoted to power station superintendent at Kirkstall power station, Leeds, Yorkshire Division, B.E.A. Since early last year he has been deputy superintendent at the station. Educated at Riley High School, Hull, and Hull Technical College, Mr Boyce served his apprenticeship with the Hull Corporation Electricity Department. During the war he served in the Navy, attaining the rank of Lieutenant (Electrical) R.N.V.R., and afterwards rejoined Hull Corporation. In 1947 he was appointed to the Meaford generating station where he became shift charge engineer, leaving in 1950 to take up a similar post at Poole generating station. He was promoted to operation superintendent there in December, 1950, relinquishing that position in January, 1953, to go to Kirkstall.

An engineer with the Design and Construction Department, Electrical Branch of the State Electricity Commission of Victoria since 1951, **Mr A. C. S. Hughston,** DIP.E.E., has been appointed electrical superintendent, Kiewa, in that department.

Sir Wavell Wakefield, M.P., has been elected president of the Electric Vehicle Association of Gt. Britain Ltd. for the ensuing year. Other officials appointed at the Association's annual meeting were: chairman, **Mr J. Wilkie** of Chloride Batteries Ltd.; vice-chairman **Mr H. W. Heyman,** B.SC., M.I.E.E., director of Smith's Delivery Vehicles Ltd.; and hon. treasurer, **Mr N. Hindle,** of Hindle, Smart and Co., Ltd.

Mr Joseph Walton, joint managing director of Thos. W. Ward Ltd., has completed 50 years' service with the company, and at a dinner given in his honour at the Royal Victoria Hotel, Sheffield, recently, he was presented by the directors with a silver rose bowl. **Mrs Walton** received a diamond spray brooch. The presentations were made by **Mr Ashley S. Ward,** president of the company.

Mr E. A. Udall, chairman of Gabriel Wade and English Ltd., is to retire from the board on 31 May. Mr Udall joined the board of the company as financial director in 1920 and was appointed chairman in 1948.

Mr N. M. Speer, general manager of the Auckland Electric Power Board, New Zealand, has been elected president of the New Zealand branch of the Chartered Institute of Secretaries.

Regarding the acquisition by J. Stone & Co. (Holdings) Ltd., of the engineering interest of Chance Brothers Ltd., to which we referred on 6 May, we are asked to make it clear that **Mr John Raymond** has retired from the managing directorship of Chance Brothers in order to be managing director of the new Company, Stone-Chance Ltd. The new managing director of Chance Brothers is the former technical director, **Dr Hampton.**

Lt.-Col. C. Hardie has, in view of his responsibilities as joint managing director of the Southern Areas Electric Corporation Ltd., resigned his directorship of some of the company's subsidiaries, while retaining others. He continues as technical director on the holding company's board.

Among the new Justices of the Peace appointed for Hove is **Mr Norman R. Elliott,** O.B.E., M.A., M.INST.C.E., M.I.E.E., chairman of the South Eastern Electricity Board.

Capt J. C. M. Hay, O.B.E., chairman of the Southern Electricity Consultative Council, has become a Deputy Lieutenant of Hampshire.

Mr E. A. J. Ashton, contracting superintendent for the Torbay district of the South Western Electricity Board, has been presented with a certificate and a gift in recognition of his 35 years' service in the supply industry.

Mr L. J. Attewill, A.M.I.E.E., has been appointed a director of the Electrical Apparatus Co. Ltd. He joined that company as an apprentice in 1930, and after completion of his practical training, became a member of the technical staff, and in 1938, head of the Automatic Control Gear Department. Since 1949 he has been assistant sales manager, technical organiser and a member of the company's management committee. Mr Attewill was the secretary of the Electric Motor Control Gear Productivity Team, which visited the U.S.A. in the winter of 1949/50. In his new appointment he will be responsible for production matters.

The Minister of Fuel and Power has appointed **Sir Lawrence Bragg,** O.B.E., M.C., F.R.S., and **Prof H. W. Melville,** F.R.S., to be members of his Scientific and Advisory Council from 1 Sept. next. Sir Lawrence Bragg was recently elected President of the Electrical Research Association. Prof Melville has been Mason Professor of Chemistry at Birmingham University since 1948. He is also a member of the Research Council of the British Electricity Authority.

Mr R. B. Potter, chairman of Simon-Carves Ltd., has been elected chairman of the Water-Tube Boilermakers' Association, and **Mr J. B. Woodeson,** O.B.E., chairman of Clarke, Chapman and Co., Ltd., has been elected vice-chairman of the Association.

Mr F. W. Joyce has been appointed manager of the Household Appliance and Domestic Equipment Department of the Liverpool branch of the General Electric Co., Ltd., under the general managership of Mr G. L. Butler. Mr Joyce joined the G.E.C. in 1933 and served an apprenticeship at Witton Engineering Works and Magnet Works, Birmingham. After war service, including four years as a p.o.w., he returned to the G.E.C. in 1946, and was appointed technical sales engineer in Domestic Equipment Department. In this capacity he represented the company on the Technical Committee, Domestic Cooker Section of B.E.A.M.A.

Elected president of the Aluminium Development Association for the ensuing year is **Mr R. T. Priestman,** managing director of T. J. Priestman Ltd. The new vice-president of the Association is **Mr R. D. Hamer,** of Aluminium Laboratories Ltd. **Mr Harold Goodwin,** of Birmetals Ltd., was appointed chairman of the Executive Committee of the Association in succession to **Mr G. W. Lacey.**

The third annual Birmingham Electric Club Scholarship has been awarded to **Mr R. T. Sartain,** an estimator with General Electric Co., Ltd., at Witton Works. This scholarship is open for award to part-time students (under 28 years) in the Electrical Department of the College of Technology, Birmingham.

At the Manchester University Founder's Day last week, Honorary Doctorates of Laws were conferred upon **Sir Arthur Fleming,** C.B.E., M.SC.TECH., D.ENG., F.C.G.I, HON.M.I.E.E., M.I.MECH.E., F.INST.P., director of research and education, Associated Electrical Industries Ltd., and on **Sir Joseph Hallsworth,** M.A., chairman of the North Western Electricity Board.

The First Prize in the Jubilee Essay Competition of the Institute of Foundrymen has been awarded to **Mr D. F. Bailey,** a member of the Research and Development Department of Bakelite Ltd. Mr Bailey is in charge of that company's experimental foundry which has played a prominent part in the development of the shell-moulding method of making foundry moulds and cores.

The Minister of Fuel and Power has appointed **General Sir Frank E. W. Simpson,** K.C.B., K.B.E., D.S.O., to be a part-time member of the Eastern Electricity Board.

Bailie Bruce Russell, who is engineer and manager for Johnson and Phillips Ltd. in Scotland, has been appointed a Magistrate of the City and Royal Burgh of Edinburgh. He is also a director of J. and P.'s associated company, Aurora Lamps Ltd.

At present lecturer in electrical engineering at the University of Glasgow, **Dr John E. Parton,** B.SC., PH.D., A.M.I.MECH.E., M.I.E.E., M.AMER.I.R.E., has been chosen to succeed **Prof H. Cotton** in the Chair of Electrical Engineering at the University of Nottingham. Dr Parton graduated with First Class Honours in Electrical Engineering at University of Birmingham in 1936. After a period as part-time lecturer at Cannock Chase Mining College, he served in a similar capacity at Northampton Polytechnic from 1938 to 1939. His war-time service began as sub-lieutenant, R.N.V.R. Electrical, Rosyth Command, and he was demobilised in January 1946 and granted the retained rank of Electrical Lieutenant-Commander, R.N.V.R. He then joined the University of Glasgow as lecturer in electrical engineering. Since 1947 he has been assessor for I.Mech.E., and I.E.E. for H.N.C. examinations for Scotland, and external examiner for diplomas for Heriot-Watt College. Dr Parton has had considerable research experience, including a short period at the Cavendish Laboratory, Cambridge.

Mr F. N. Pardow has joined George H. Scholes and Co., Ltd., as assistant sales manager.

Also involved in the car crash when returning from the B.I.F. at Birmingham on the night of 12 May in which **Mr J. W. Roffey** and **Mr L. W. G. Russell** were killed (see page 750) were **Mr R. W. Naylon,** ASSOC.I.E.E., engineer (meters), Northern sub-area of the London Electricity Board, and **Mr O. G. W. Davis,** ASSOC.I.E.E., sub-area meter engineer in the North Western sub-area of the London Electricity Board. We are pleased to report that Mr Davis was only slightly injured, and Mr Naylon, who suffered severer injuries and is detained in hospital, is making satisfactory progress.

District manager at Chorley to the North Western Electricity Board, **Mr H. Ashworth,** A.M.C.T., A.M.I.E.E., is relinquishing that post at the end of this month to join Associated Clay Industries Ltd.

Mr J. A. Nevitt, B.SC., has been appointed as section engineer of the newly-established Carmarthen Bay section of the South Wales Division of the B.E.A. Since 1950 he has been assistant section engineer at the Division's Neath Section. The South Wales Division have also appointed **Mr T. M. Jones,** A.M.I.E.E., as chief draughtsman at the Divisional Headquarters and he will take up that appointment on 1 July. Mr Jones is section leader draughtsman at the Bankside offices of the Central Authority. Earlier he was senior design draughtsman with McLellan and Partners.

Appointed manager of the London district office of the Edison Swan Electric Co., Ltd., is **Mr K. S. Estlin,** O.B.E., M.C., T.D., ASSOC.I.E.E., who for the last three years has been managing director of Uni-Gun Lubricating Equipment Ltd. Mr Estlin completed an apprenticeship course with the Metropolitan-Vickers Electrical Co. at Trafford Park in 1930 and subsequently served on the staff of the company in the Marine Department at the Works and in the London district office until mobilisation in 1939. On release from the Forces, Mr Estlin rejoined Metrovick and, following a refresher period at the Works, was appointed manager of the Plymouth Office. He vacated that post in 1949 to join Uni-Gun Lubricating Equipment Ltd.

Dr J. E. Parton

Mr K. S. Estlin

Mr. D. F. Bailey

Station superintendent at Llynfi power station, South Wales Division, B.E.A., **Mr J. Palmer Rees,** A.M.I.E.E., is to retire at the end of June after completing 47 years in the Supply and Contracting Industries in this country and in India. From 1907 to 1911 Mr Palmer Rees was employed first by the English Construction Co., and then by the British Thomson-Houston Co. From 1911 to 1920 he was engaged on power station construction for the Indian State Railways and in 1920 joined the South Wales Electrical Power Distribution Co. His successor as station superintendent at Llynfi is **Mr C. Carrick,** A.M.INST.F., who has been deputy superintendent there since last year. Educated at Dumbarton Academy, Mr Carrick later joined William Denny Brothers Ltd., and for eighteen months was engaged on experimental work on turbines. From 1927 Mr Carrick held various power station appointments in India with the Cawnpore Electric Supply Corporation Ltd., being station superintendent in 1946 prior to his return to this country. In that year he was appointed station superintendent at Lydney power station.

Manager of the Central sub-area of the South Wales Electricity Board, **Mr E. W. Jones** has been elected High Constable of Miskin Higher.

At present assistant director of research at the Tin Research Institute, **Dr J. W. Cuthbertson,** D.SC., A.M.I.E.E., has been elected to the recently endowed Cripps Chair of Metallurgy at the University of Nottingham. He takes up his new duties in October.

Lecturer in the Electrical Engineering Department of the Heriot-Watt College, Edinburgh, since 1945, **Mr A. G. Thomson,** B.SC., A.M.I.E.E., M.I.R.E., has resigned that post to take up the appointment as the first Principal of Kingston Technical School, Jamaica. He will also be adviser to the Government of Jamaica on the development and expansion of technical education in the island.

Mr L. P. Morinan, A.M.I.MECH.E., A.M.I.E.E., station superintendent at Cardiff power station, South Wales Division, B.E.A., is to retire on 17 June next; appointed to succeed him is **Mr C. Archibald,** M.I.MAR.E. Mr Morinan was apprenticed at the Cardiff Engine Works in 1907 and from 1912 to 1914 served as a marine engineer. In 1914 he joined the Cardiff Electricity Department and since that date has been continuously employed on power station work, by the Cardiff Corporation until vesting date and subsequently by the B.E.A. in the South Wales Division. Mr Morinan attained his present position of station superintendent at Cardiff power station in September 1946. Mr Archibald, who has been deputy station superintendent at Cardiff power station since 1951, earlier spent three years as mechanical maintenance engineer at Tir John power station, Swansea. Educated at the L.C.C. School of Engineering and later at the Borough

Polytechnic, London, Mr Archibald obtained early practical training with Coubro and Scrutton Ltd., after which he served as a sea-going engineer for six years. In 1929 he joined the Southwark Borough Council Electricity Department and at vesting day was assistant maintenance engineer with Coventry Corporation Electricity Department at Longford power station. He went to Tir John in 1948.

The long service awards to employees in the Electricity Supply Industry, including **Mr J. B. Jackson,** chief generation engineer (operation), to which we referred last week, related to the Northern group of the North Eastern *Division* of the B.E.A.

At the annual general meeting of the Institute of Export, when **Mr Leslie C. Gamage,** M.C., was re-elected president. **Mr D. Maxwell Buist,** export director of B.E.A.M.A., retired from the position of Chairman of Council, which he has held for three years. He is succeeded by **Mr J. P. Ford,** M.A., managing director of National Oil Engines (Export) Ltd., Associated British Oil Engines (Export) Ltd., and Brush Export Ltd. At a Council meeting last week Mr Buist was presented with a Parker 'Magnetix' desk set in appreciation of his three years' service as chairman.

From Marconi's Wireless Telegraph Co., Ltd., we learn that **Mr R. E. Burnett,** M.A. (OXON.), A.M.I.E.E., A.INST.P., has been appointed assistant to the general manager, for special duties. He will retain his responsibilities as manager of Education and Technical Personnel and will remain principal of Marconi College. Mr Burnett is also officially confirmed as adviser on technical staff matters to the associated companies at home and overseas. In view of Mr Burnett's additional responsibilities the following appointments have been made: **Mr E. R. L. Lewis,** M.A., A.M.I.E.E., has been appointed deputy manager, Education and Technical Personnel; **Mr R. G. Hulse,** B.SC., (HONS.), has been appointed deputy principal of Marconi College and Director of Studies; and **Mr J. Lindsay Scott,** ASSOC.I.E.E., has been appointed chief of Technical Personnel Recruitment. The company also announces that its maritime business, which has hitherto been handled by Central Division, is now taken over by a newly formed Maritime Division. In order to organise this, **Mr G. R. Tyler** has relinquished his position in Central Division and has been appointed manager, Maritime Division. **Mr R. H. Deighton** succeeds Mr Tyler as manager of Central Division. **Mr J. Watt,** B.SC. (HONS.), D.I.C., has been appointed chief engineer, Maritime Division, technically responsible to the engineer-in-chief, and retaining his present responsibilities for marine development. The Services Equipment Division will henceforth be known as Radar Division. **Mr H. J. H. Wassel,** O.B.E., B.SC.(HONS.), has been appointed chief engineer, technically responsible to the engineer-in-chief, and maintaining his present responsibilities for radar development. Apart from this appointment, the personnel constitution of the newly-named Division remains unchanged.

OBITUARY

Mr J. W. Roffey, London area manager of Sangamo Weston Ltd., was killed when motoring to London after a visit to the B.I.F., Birmingham, on 12 May. Also killed in the accident was **Mr L. W. G. Russell,** A.M.I.E.E., meter and test superintendent, Northern Sub-area of the London Electricity Board. Mr Roffey, who was 45, had been with Sangamo Weston Ltd. since 1924, being first employed with Assembly and Testing Departments. After gaining experience in all production departments, he became contracts engineer in 1936. During and since the war he specialised largely in instrumentation for all types of aircraft and played a considerable part in the development of many types of electrical instruments. He was appointed London area manager in 1950. Mr L. W. G. Russell entered the Electricity Supply Industry in 1934 after gaining earlier experience with Chamberlain and Hookham Ltd. He was with the Electricity Department of the Metropolitan Borough of Hackney until nationalisation and in September 1948 was appointed meter and test superintendent for the London Electricity Board's Northern sub-area.

Mr J. Harris, representative for the Midlands for H.M.V. Household Appliances, died recently, aged 54.

Mr S. Harper Bill, D.S.C., B.SC.(ENG.), formerly managing director of the General Accessories Co., and a director of British Mechanical Productions Ltd., died on 17 May, aged 70. When those companies were taken over by Edison Swan Electric Co. late in 1951 he acted in a commercial advisory capacity until retiring in 1952. Since then he operated a consulting practice.

NEW LITERATURE

Electrical Contractor's Annual 1954

ed. J. Rosslyn-Stuart

FOR its second appearance this annual is increased in size and, unfortunately, in price. The general pattern of the work, however, is unchanged. A series of articles by specialists makes up the greater part of the book, and these are followed by a section giving the usual miscellany of technical information which all connected with the electrical industry find that they need at some time. Finally, marked off for ready reference, there is a usefully lengthy list of trade names and addresses.

It is a point of recommendation for the Annual that where articles appear with the same subjects as in the 1952-53 edition, they have obviously been thoroughly revised and brought up to date. Notable new subjects of articles are: main panel design, lift and hoist maintenance, farm wiring, earth leakage c.b.s. and television servicing. Once again a valuable reference volume has been achieved. Published by E. and F. N. Spon, 358 pages, 8½ in. by 5½ in. Second edition, price 18s.

The Synchronous Induction Motor

by J. Griffin, A.M.I.E.E.

THE textbooks on which our engineering education is based give extensive attention to the more common types of rotating machines. To obtain information outside these limits, it is usually necessary to visit a library and chase references through a wide variety of technical publications. Now and again, however, a specialist textbook comes to hand, and the wearisome search is over. So far as synchronous induction motors are concerned, the present volume will serve in this capacity for many years to come. More than that, it contains the type of information that is so often the object of such a search; the explanation of performance characteristics and the discussion of design calculations and constructional details which the student engineer and the junior designer suddenly requires, together with the appreciation of special operational and economic factors that can be so helpful to the utilisation engineer faced with a choice between various designs of motor. In covering his wide field, the author works from the theory of starting, synchronising, and of running as a synchronous machine, through practical and economic considerations of power factor correction and overload capacity, to such design details as winding possibilities and exciting current calculations. Throughout his chosen range, however, he maintains a clarity of expression which should seal the success which the subject matter of the book makes probable. Published by Macdonald and Co. (Publishers) Ltd., 136 pages, 8½ in. by 5½ in. Price 18s.

BOOKS RECEIVED

The Electromagnetic Field in its Engineering Aspects, by G. W. Carter. Gives non-mathematical and comprehensive view of theory of electromagnetism with constant reference to engineering applications for engineers. Published by Longmans, Green and Co., 360 pages, 8½ in. by 5½ in. Price 35s.

Mathematics in Action, by O. G. Sutton. An account, for engineers, of applied mathematics showing its influence on modern ideas of the nature of the universe. Published by G. Bell and Sons, 226 pages, 8½ in. by 5½ in. Price 16s.

Basic Principles in Electrical Engineering, by J. H. Child. For both students and post graduate engineers, describing underlying principles of a number of subjects in electrical engineering. Published by E. and F. N. Spon, 112 pages, 7¼ in. by 4¼ in. Price 10s. 6d.

PROBLEMS AND PRACTICE

In Engineering

Works Fire Alarm

THE use of a staff locator system in any works or large building offers a unique opportunity for the operation of a discriminating fire alarm and evacuation service. In our case we had already a system in use employing F, 1, 2, 3, 4, 5 and 6. As a visible system we could use the numerals for ordinary staff location, and in combination with "F" distribute a fire warning.

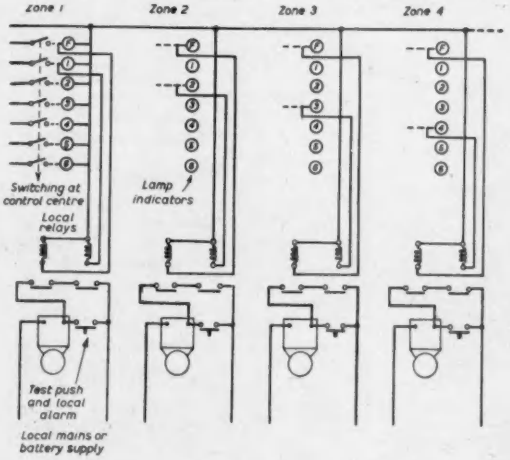
It was decided to effect an improvement on the above scheme by the use of electric bells in addition to the visible warning. The site was divided into six zones, and bells were installed in each zone, their number depending on the area covered. The control of all locator units is situated in the works telephone exchange, and the operator receiving a fire report from, say, Zone 1 will switch on F1, and this sign will, of course, appear on all locators in all areas, but only the bells in zone F1 will ring, enabling this area to be evacuated without affecting other zones. Should other zones be later threatened the operator will switch to F2, F3, F4 as the case may be, and the bells in those zones 2, 3 or 4 will also ring.

The diagram shows the genera arrangement of the wiring scheme. It will be seen that two relays are necessary in each zone position to prevent the alarm system from operating while the locators are used for their normal staff location purpose.

A local push button is provided adjacent to each zone relay in order that weekly tests may be carried out, and also to provide a local immediate alarm point if required.

The main control at the works exchange is tested weekly to ensure correct operation of all equipment. The local supply circuits should not be fed from adjacent lighting or plug points but should run back to a separate circuit not likely to be interrupted. Failing this a separate battery supply must be used for the purpose.—*W.H.R.*

The combined system for a works fire alarm and staff locator



Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

System Earth Faults

THE information supplied by Mr Ogden on this subject (in the 8 Apr. issue) confirms the deductions made in my earlier contribution. An 11 kV earth fault is limited by the reactor to 210 amps which causes current to flow in two phases of the 6·6 kV supply to the transformer. The primary line current is $(210 \times 11) \div (\sqrt{3} \times 6{\cdot}6) = 203$ amps. The full load primary current of the transformer is 175 amps so the 200 amp setting is probably in use as any lower plug setting would be less than the rated current of the transformer. The inverse time relay at A would, therefore, not operate and the simple earth fault would only be cleared when a complex fault had developed.

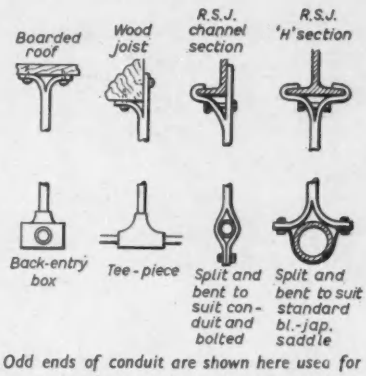
Mr Ogden's remarks regarding tuned reactors are not correct although it is true that they are associated chiefly with overhead line systems because transient faults can be cleared without the disconnection of feeders. This form of earthing has been used on cable systems and although difficulties are greatest with large cable networks there have been many applications in large cities including Geneva and Berlin. The advocates of tuned reactors claim that even under these conditions it is possible to maintain supplies until an earth fault can be repaired.

My original contribution considered both forms of reactor earthing because complete information was not available and in this country the usual method is the neutral resistance.—*J. C.*

Conduit Supports

ODD ends of conduit may be put to very good use as substitutes for girder clips and support brackets, when the necessary materials are not readily available. Four methods that the writer has used for supporting a conduit run from roof members are shown.

Where the tube has to be split, first ascertain the length of bend required, then make a suitable sawcut along the centre line of the tube. It is an easy matter to prise apart the two sections, hammer them flat, then drill and bend where necessary.—*W. Clegg.*



Odd ends of conduit are shown here used for girder clips and other support brackets

Star or Delta

FOLLOWING a letter, the writer had been sent to a small engineering firm regarding a 10 h.p. star-delta motor. According to report the motor had been running very hot, also the circuit breaker had been tripping out. On arrival, I found that the original 8 h.p. motor, driving a shaping machine, had burnt out and had been replaced by a 10 h.p. motor. This was working under reversable conditions although not designed for reversal, and might therefore also burn out.

After a little deliberation it was decided to check up the starting current by the aid of the long ammeter. On starting up, the current indication was over 100 amps. The motor was delta connected. With the object of cutting down the starting current I decided as an experiment to reconnect the motor on "star." The current again was checked up—it indicated 30 amps.

Although unorthodox it seemed, for the present, the only way out. Luckily there was no likelihood of a repeat of the same type of job.

Since altering the connection to "star" the motor has been working for 8 hours a day for the last six weeks, with no complaints.—*Novis.*

Equipment for Industry

Plating by the "Dalic" Process

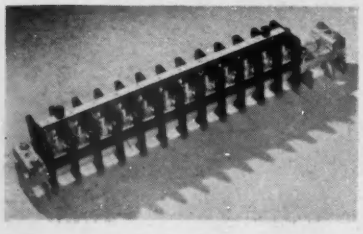
WHERE it is required to electro-plate parts difficult of access or which it is undesirable to dismantle and place in plating solutions, the "Dalic" process, offered by METACHEMICAL PROCESSES LTD., 13 Strafford Rd, W.3, holds out many advantages. Not intended to compete with conventional bath methods, the "Dalic" process involves only small amounts of the plating solution together with a special cleaning liquid, electrode and power unit.

In operation, the part to be plated is made the cathode by being clipped to a lead from the power unit and a tampon is employed as the anode, a cotton-wool pad wrapped round the end holding the plating solution. After carefully cleaning the metal surface, the tampon pad is dipped in the plating solution, the current density set to the required value, and the tampon pad then rubbed over the work, building up an electrodeposited coating. The power unit employed is a Westinghouse transformer rectifier cubicle giving a maximum output of 40A. As a result of the special plating solution employed, high current densities can be used, giving rapid deposition of the metal and thus making the process eminently suitable for building up worn journals or over-machined parts.

Multiple Terminal Assembly

RECENTLY added to the "Astral" range of distribution equipment is a multiway terminal assembly which should find many uses in installation work. Available from ASTRAL SWITCHGEAR LTD., Enfield, Middlesex, the assembly is of unit construction in a high quality black phenolic moulding. Basically, the assembly comprises twin metal support bars on which are mounted link blocks, each separated by an insulating fillet. Key ways on fillet and blocks ensure accurate alignment. The complete assembly of blocks is locked rigidly by a clamp bracket at each end, these brackets also serving as fixing centres. With this arrangement, terminal blocks may be extended as required to the capacity of the support bars.

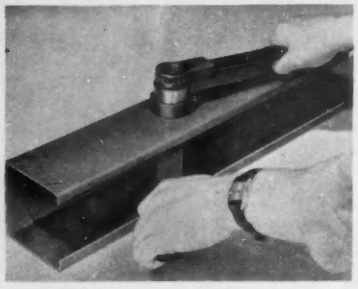
"Astral" multiple terminal strip



A transparent plastic shroud and a numbered identification strip protect the terminals from chance contact, the shroud being held in place by knurled-head screws locating in fillets. Suitable for conductors up to 7/·052 in. in size, the assembly is rated continuously at 60 amps, 660 V. For test or bifurcating, two- and three-way shorting links are available.

Cutting Holes in Cable Trunking

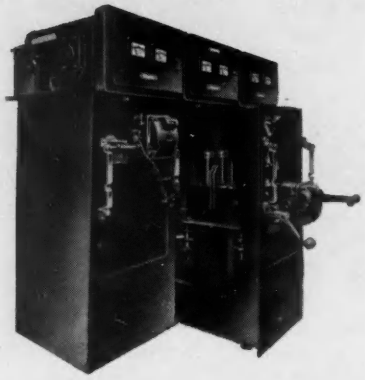
TO meet a demand for means of cutting holes in sheet steel cable trunking which will not be cumbersome, heavy or awkward in operation, the DAVIS SHEET METAL ENGINEERING CO., LTD., 54 Islington Park St, N.1, have recently introduced the "Quick" punch. It is a hand-operated tool, and whilst capable of being carried in the pocket will cut holes up to 2 in. diameter in 16 s.w.g. sheet. Moreover, it enables holes to be cut in cable trunking already fixed to a wall or structure without the use of heavy power tools or the need for a skilled operator. To use the tool, it is first necessary to drill a ¼ in. clearance hole on the centre of the hole required. The ½ in. punch is then assembled and, using either a ratchet type or an ordinary spanner, the punch is drawn through the die to cut a ½ in. hole, after which the required size is selected and the final cut made. Punches in sizes of ½ in., ¾ in., 1 in. 1¼ in., 1½ in and 2 in. dia. are available at prices ranging from 15s. 3d. to 54s. 5d. whilst a complete kit, together with a bar type and ratchet type spanner costs £10.



The Davis "Quick" punch is seen here in operation

Ellison's 11 kV, 250 MVA, o.c.b. Unit

THE latest addition to the "Ellison" range of switchgear, an oil circuit-breaker for 11 kV, three-phase systems having a short-circuit rating of 250 MVA, meets the modern demand for economy of space and "clean" lines whilst maintaining the advantages of easy access to its interior. Introduced recently by GEORGE ELLISON LTD., Perry Barr, Birmingham 22B, it complies with the requirements of B.S. 116:1952 (an A.S.T.A. certificate of short-circuit rating is being prepared), the breaker incorporating arc control devices of the cross blast type, these being easily removed for contact inspection. Direct-acting, over-current, shunt and e.l. trips can be provided as required.



Ellison's latest 11kV o.c.b. has a short circuit rating of 250 MVA

Each c.b. unit comprises a stationary cell, surmounted by busbar and c.t. chambers, and a withdrawable truck carrying the breaker. Self sustaining gearing operated by a handle enables the breaker to be easily lowered to isolate it from the bars. Any number of units may be mounted together, extensions being readily made. Provision for manual or power closing by spring or d.c. solenoid is made as specified, full locking and interlocking systems being incorporated. On opening, moving contacts are arrested by oil shock absorbers. Main contacts are supported by "Tufnol" bushings and are easily replaced.

Adhesive Plastic Insulating Tape

SUITABLE for electrical insulating, sealing, binding, wrapping, identification and decoration purposes is the plastic, adhesive insulating tape manufactured by Heddesco Ltd., Heddonia House, 374 Euston Road, N.W.1. Recently introduced to the market, the tape goes under the name of "Heddo-Tape" and is available in eight colours. Its manufacturers claim for it many advantages over the conventional black cotton tape, prime among which is a stated dielectric strength of 10 kV (against the British Standard requirement of 1,000 V for black tape). With this high value a single layer of "Heddo-Tape" is claimed to give complete electrical insulation; and consequently can afford considerable savings in time and cost of taping parts to be insulated.

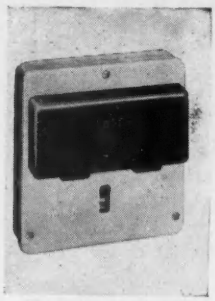
By virtue of its being a plastic material, the tape has a high resistance to corrosive, moist or oily conditions whilst providing an effective seal and good finish. It is supplied in rolls of 2½, 5 and 10 yds for electrical purposes, in widths from ½ to 2 in. and a standard thickness of 0·006 in.

Siemens "Newtype" Consumers Unit

THE introduction of the "Newtype" Consumers' service unit is announced by SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., 38-39 Upper Thames St, E.C.4. Available in 4, 5 and 6-way patterns, both metalclad and insulated types of the unit are obtainable.

Chief considerations in the design of this unit was the elimination of unnecessary refinements thus producing a high quality and efficient apparatus as low in price as possible.

Ample space and facilities for wiring are provided, with knock outs for conduit entry at top, bottom, both sides and back. A specially designed short break switch allows for solid copper connections to the fuse-bank busbar and also carries the neutral block.



The "Newtype" unit

Any combination of fuse-ways—5, 15 or 30 amp, can be supplied, fuses being standard domestic pull-cap type for H.R.C. cartridge fuse links to B.S.S. 1361, Spare cartridges are included in each "Newtype" unit.

Dimensions of the metalclad unit are 7¼ in. by 6⅞ in. by 3¼ in. and is finished in cream vitreous enamel with a black plastic snap-to cover over the fuses. The insulated model in black Bakelite is slightly larger.

Trade Publications

PYROMETERS, ETC.—Latest Thermoelectric pyrometer catalogue No. 112 superseding catalogue No. 103 has been published by FOSTER INSTRUMENT CO., LTD., Letchworth, Herts.

ALUMINIUM ALLOYS.—HIGH DUTY ALLOYS LTD., Slough, Bucks, have issued a booklet showing the foreign equivalents of all Hiduminium aluminium alloys.

PIPEWORK.—Two new brochures by AITON AND CO., LTD., Stores Rd, Derby, are (a) a 1954 brochure about the pipework fabricating activities of the company and (b) a descriptive list of supports for pipework.

TRANSFORMERS.—IOMS No. 417/4-54 issued by A. REYROLLE AND CO., LTD., Hebburn, Co. Durham, gives installation and maintenance recommendations for oil filled post-type current transformers, 88 kV to 275 kV.

MOTORS.—HARLAND DRIVES LTD., 20 Park St, W.1, have published a booklet surveying the use of their equipment for paper and board making machines.

INSTRUMENTS.—A well-bound comprehensive catalogue of Marconi Instruments for telecommunications and industrial electronics is now available to senior engineers and executives on request to MARCONI INSTRUMENTS LTD., St. Albans, Herts.

Heatrae's Towel Rail/Heater

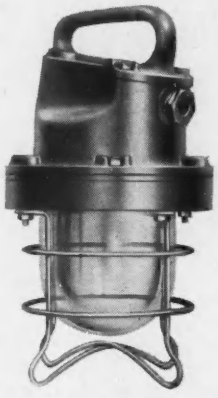
WHEN the coming summer months draw to a close there will be a great demand for safe efficient space heating units. One room in the house where changes in temperature are most marked is the bathroom and here the combined air warmer/towel rail marketed by HEATRAE LTD., Norwich, comes into the view.

This unit, which stands either 20 in. high (wall model) or 36 in. high and is 36 in. wide, is well finished in chromium plate and provides adequate heat for both warming the bathroom and causing a convection current to dry the towels or to air garments before wearing.

Both floor (TDF) and wall type (TDW) are rated at 500 W and cost respectively £21. 19s. plus £8. 0s. 6d. (tax) and £17. 10s. 6d. plus £6. 8s. 2d. (tax). Extra heavy bases for type TDF towel rail cost £1. 2s. plus 8s. 1d. (tax) while additional wall fixing brackets for this model cost £2. 2s. plus 15s. 5d. (tax).

The "Wigan" Flameproof Handlamp

CERTIFIED for flameproofness under Groups II and III (Cert. No. 3213) and robustly made, the "Wigan" flameproof handlamp listed No. 407 by the manufacturers, HEYES AND CO. LTD., Water - Heyes Electrical Works, Wigan, Lancs., is suitable both for 40 and 60 W lamps.



The main enclosure, to which the bezel ring holding the glass and guard is secured, is of cast aluminium. It contains a porcelain b.c. or e.s. lampholder which is connected by heat-resisting cable to the insulated busbar passing into the joint box. This is cast integral with the main enclosure and is fitted with a packing gland for cable entry. It is possible to clamp the cable and to earth the screens and earth core to a fitment inside the box. The lid of the joint box also forms the handle.

The company point out that a condition of the grant of the flameproof certificate is that only tough rubber sheathed 3-core cable with individually screened cores not less than 23/-0076 is used with the lamp.

For the Electrical Trade

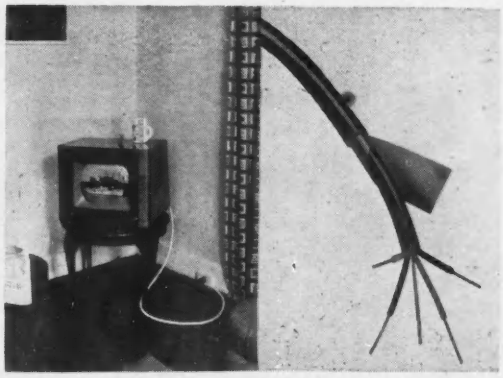
New TV Relay Cable

IN preparation for the introduction of supplementary television programme, BRITISH INSULATED CALLENDERS CABLES LTD., Norfolk House, Norfolk St, W.C.2, have developed a new range of precision cables in which the cross-talk interaction has been reduced to a low level.

Using these cables British Relay Wireless and Television Ltd. have engineered a television relay system capable of distributing a television programme on each pair of a screened quad cable at a common-carrier frequency thus reducing the subscriber's selective apparatus to a simple switch.

This network now being erected to serve the area of S.E. London, comprises two screened quads which between them provide four vision channels on a common carrier frequency and five audio channels, the fifth audio channel being the circuit provided between the screens of the two cables.

Polythene is used for the insulation, filling, belling and sheathing of these precision quads which have plain copper conductors and lapped copper tape screens. A feature of this new range is that the three larger cables intended for the main distribution network of a system have the same characteristic impedance.



B.I.C.C.'s new cable range makes four channel relay television a simple installation

NEWS OF THE WEEK

L.E.B. to reply on Assisted Wiring

CAPITAL RESTRICTIONS WILL NOT ALLOW REINTRODUCTION YET

A REPLY has now been formulated by the London Electricity Board concerning requests for the resumption of an assisted wiring scheme, and is expected to be given at a private meeting shortly between representatives of the Board and the Metropolitan Boroughs' Standing Joint Committee. The Board has been considering this matter since the Committee's meeting last February when a resolution to ask the Board to reintroduce such a scheme was passed and forwarded to the L.E.B. We understand that the Board is entirely sympathetic with the request but cannot at present reintroduce the scheme because of limitations in capital expenditure. All available capital is now being allocated to other more vital needs, such as reinforcing distribution networks. There is no antagonism towards the suggestion, in fact the Board appears only to have rejected the idea temporarily. As and when more capital becomes available it seems likely that the Board will reconsider the proposal and bring back a system of assisted wiring. This might not of course be possible for some years.

It may be recalled that this matter was first brought to public notice by the Deptford borough council last Nov. They found that although responsibili.y for defective wiring rested between the landlord and the tenant, in many cases the landlord refused to pay, and the tenant was left either with a large bill or no electrici.y. Under the pre-nationalisation arrangement the council would pay the bill and recover the cost over a period. Now the L.E.B. continues to maintain installations under the old scheme, but the practice has been discontinued in respect of new installations. Deptford suggested that the old arrangement should be reintroduced, forwarded their proposal to the Standing Joint Committee, and the views of London's other borough councils were sought.

I.E.E.'s New Model Form For Export Contracts

A NEW model form of General Conditions of Contract has been prepared by the joint committee of the Institutions of Mechanical and Electrical Engineers. It is known as B3 "Export Contracts (including Delivery to and Erection on site of Electrical and Mechanical Plant)." The new model form supersedes the provisions of the existing B2 which dealt with this type of contract for electrical work. The B2 continues to be available, however, for use in electrical export contracts involving supervision of erection only. Consideration is being given by the committee to the preparation of additional model forms of contract for export. The new form costs 5s. and together with the others now available, may be obtained from the secretary of the I.E.E. at Savoy Place, W.C.2.

Irish Cable for Australia

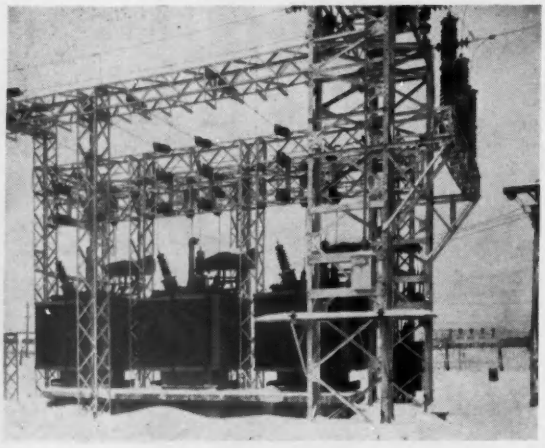
IT WAS reported in Dublin last week that a large consignment of cable is being shipped to Australia. The manufacturing company who gained the order despite U.S. and European competition, is Aberdare Electric Co., of Finglas, Dublin. The consignment is significant because it is the first time Irish manufactured cable has been sent to Australia, although the same company has dispatched a similar order to S. Africa.

S.E.B. AMALGAMATE CERTAIN DISTRICTS

AN amalgamation of certain districts in the Southall sub-area has been put into effect by the Southern Electricity Board. A new Maidenhead district has been formed, operating from Braywick Rd, absorbing the former Slough district and the northern part of the Bracknell district. The southern part of the latter district is now incorporated in the Staines district. It is hoped that this re-organisation will result in administrative economies, and a saving in capital costs, as the old Slough district office was due for re-building. District manager at Maidenhead is Mr R. S. Gosling, with Mr A. Pearce as district engineer and Mr A. G. Brion as district commercial engineer. At Staines, Mr N. M. Wallace is district manager, with Mr L. B. Tyler as district engineer and Mr. P. J. Jenning as district commercial engineer.

B.I.F. is the Cheapest Exhibition in Europe

THE British Industries Fair was criticised at the official luncheon organised in connection with the exhibition last week. It was described as a very cheap exhibition by Mr D. D. Walker, chairman of the B.E.A.M.A. council, who was one of the principal guests. He said the Fair was the cheapest exhibition for exhibitors in Europe and urged careful thought into the question of whether we were going to be satisfied with difficult conditions and a very cheap exhibition, or whether we were going to compete with such enterprises as the Hanover exhibition. Germany's Fair at Hanover, he said, built since the war largely at the Government's expense, had become a showpiece of the country's industry. The organisers of the B.I.F. at Castle Bromwich, Birmingham's Chamber of Commerce, in trying to stage the exhibition on its present site (an old aircraft hangar) was competing with one hand tied behind its back. Mr Walker urged careful consideration of a more fitting setting for industry's shop-window, even at added expense.



A group of three Denis Ferranti 66 kV, 60 c/s single-phase transformers forming a 10 MVA 3-phase bank installed at Valcartier, Quebec. They were supplied through the company's Canadian agents, the Eastern Electrical Supply Co., of Montreal, and as can be seen from the snow-covered ground, have to withstand severe weather conditions

Testing Electrical Installations in Prefabs

Ministry recommends Inspections Every fourteen Months

ELECTRICAL installations in temporary houses are in the news again. Following the outbreak of a number of fires in these dwellings which have been caused by faulty installations, the Ministry of Housing has sent a circular letter to all local authorities reminding them of a previous recommendation that inspections and tests of these installations should be carried out at regular intervals. The suggested interval is one of 14 months, so that a check under different seasonal loads would be ensured. The letter states that inspections of this frequency should greatly reduce the risk of fires attributable to faults in electrical installations. It urges local councils to make inspections as soon as possible if they have not been carried out in the past 14 months. Particular attention is drawn to six factors. These are bakelite moulded components in the main control panel; overheating of fuse contacts; fuse terminal connections; arcing on to metal cover; cable insulation in the control panel; and socket-outlets and switches. The circular concludes by stating that any proposal to carry out remedial works to the electrical installation in a temporary house at a cost of over £5 should be referred to the Principal Regional Officer.

One council which has agreed to carry out an inspection is Hebburn-on-Tyne, although not strictly as recommended by the Ministry. We hear that a surveyor has reported that examining every house would take 200 days and cost about £325. He suggested that tests be carried out on 10% of the dwellings, and if the number of faults was high, further examination could be made at other houses. This proposal was approved. It is understood also that Liverpool Corporation are to act in accordance with the Ministry's recommendations, although systematic testing has not yet been approved.

BEAMA AGAIN ATTACKS TROLLEYBUS PLANS

FOLLOWING their immediate rejoiner to London Transport's plan to scrap the trolleybus, B.E.A.M.A. last week criticised the Minister of Transport's statement in the House of Commons that 1830 diesel buses would be required to replace the 1,800 trolleybuses. Simple arithmetic, the Association states, reveals that to carry the same number of passengers 180 more diesel vehicles would be needed. Nor can the argument that oil buses are more mobile than trolleybuses be substantiated, the statement adds. Trolleybuses speed up traffic flow because of their greater gearless acceleration and smoother braking. As regards finance it is pointed out that in 1952, diesel buses made a deficit of £317,000, whereas trolleybuses made a surplus of £321,000. In addition, the latter contributed to London's rates, whereas oil buses do not.

HYDRAULICS RESEARCH

POWER supply projects figure prominently in the Report of the Hydraulics Research for 1953. The most notable is the investigation of a wave excluder for Dekhelia Power Station, in Cyprus. It has been found that under certain conditions waves break so as to splash the steel structure, causing considerable corrosion. A model of the station was made, and a solution found in the form of a large concrete block placed in the cooling water discharge channel. During the year, a pilot model of the Severn Estuary was completed, and this is to be used for the preliminary work in investigating the Severn Barrage scheme.

Besides work for electrical projects, the report describes various electrical instruments used in hydraulic tests.

Electricians in Coal Mines

PROPOSALS for Coal Mines (Mechanics and Electricians) General Regulations under the Coal Mines Act, which were summarised in the ELECTRICAL TIMES of 1 Apr., 1954, have now taken the form of a Statutory Instrument, 1954 No. 594. The Regulations, which affect all aspects of mechanical and electrical engineering in and around mines, come into operation on 1 Sept., 1954. The text of the Regulations is the same as that summarised in our April article.

Bogus Meter Readers

SOME concern was expressed at last week's meeting of the London Electricity Consultative Council about the visits to consumers' premises of bogus meter readers. In some districts there was considerable alarm because men had posed as meter readers and entered houses for other purposes. Suggestions of all meter readers carrying identity cards with photographs, or wearing a uniform, a special cap, or some other external sign of identity, all had their disadvantages. It was reported that the matter was discussed at a meeting of the Central Authority and Area Board Chairmen the previous day. The Council decided to forward their views.

Maudslay Scholarship

THE Junior Institution of Engineers is offering a scholarship, which will be known as the Maudslay Scholarship, to young engineers for the purpose of assisting them in their technical education and practical training. The Scholarship this year has been doubled and will be £300 for one year. Candidates must not be more than 26 years of age and must be engineers, or training to be engineers wholly or mainly interested in mechanical engineering. Closing date for entries for this award for each session is 31 July. Further information can be obtained from the Institution's Secretary, 39 Victoria St, Westminster.

OFFICIAL PUBLICATIONS

BRITISH STANDARDS B.S. 2457: 1954: Protractors for drawing office use; B.S. 2458: 1954: French Curves for drawing office use; B.S. 2459: 1954: Set Squares for drawing office use; B.S. 2460: 1954: Drawing Instruments for drawing office use; B.S. 2484: 1954: Cable Covers, Concrete and Earthenware; B.S. 115, 1954: Metallic Resistance Materials for Electrical Purposes; B.S. 1498, 1954: Gear Hobbing Machines for Turbines and Similar Devices.

Amendment slips: B.S. 1137, 1949: Synthetic-resin bonded paper sheets for use at power frequencies, amendment No. 2, PD 1839; B.S. 1154, 1952: Vulcanised rubber compounds, amendment No. 2, PD 1836; B.S. 1555, 1949: Thermostats for electrically-heated domestic hot water supply, amendment No. 2, PD 1835; B.S. 1556, 1949: Electric immersion heaters, amendment No. 2, PD 1832; B.S. 2067, 1953: Determination of power-factor and permitivity of insulating materials, amendment No. 1, PD 1838.

HYDRAULICS RESEARCH, 1953. Report of Hydraulic Research Board, D.S.I.R. H.M.S.O. 7s. 6d. (see this page).

COAL INDUSTRY. Coal Mines (Mechanics and Electricians) General Regulations, 1954. S.I. 594. H.M.S.O. 4d. (see this page). Ministry Safety Circular No. 212. H.M.S.O. 2d.

ELECTRICITY REORGANISATION (SCOTLAND) BILL. Hse. of Commons Bill. H.M.S.O. 1s.

RURAL ELECTRIFICATION. U.N. Reports prepared by experts, Vol. 1, 11s., and Vol. 2, 9s. Obtainable from H.M.S.O.

E.D.A. Brochure urges Better Street Lighting

SPECIAL attention has been drawn by the Electrical Development Association to the increased accident rate after dark as shown by analysis of official statistics. In a 24-page brochure, "A Matter of Life and Death," the Association urges the need for better street lighting. It should be of particular interest to municipal lighting engineers, members of local authorities, and all concerned with street lighting.

The most suitable light sources for main road lighting are fluorescent lamps and mercury and sodium discharge lamps, it is stated. These are rapidly superseding tungsten filament lamps because they use less electricity and require less maintenance. Economy in operation and cost are dealt with briefly, while graphs illustrate the statistics of fatalities. A lesson to be drawn is that the majority of existing street lighting is not good enough for safety at night. The radical overhaul of present street lighting was the first essential for road safety after dark, the brochure concludes.

Following our illustration last week of Huncoat power station we feature a recent lighting installation at Rye House this week. The turbine hall shown here is 280 ft long and 115 ft wide between crane rails at present, although with future additions the length may increase to 420 ft. Lighting is from four rows of Atlas FKQ/3080 reflectors suspended from the roof girders, supplemented by parabolic reflectors beneath the crane rails. Over 700 5 ft 80W "white" fluorescent tubes have been used in the hall. The installation was planned by the B.E.A.'s Eastern Division, in consultation with Thorn Electrical Industries Ltd., who also supplied lamps and fittings, and was carried out by the Eastern Board

SILICONE EXHIBITION OPENS IN NOTTINGHAM AT START OF U.K. TOUR

A TRAVELLING exhibition presenting a pictorial story of silicones to British industry opens for the first time in Nottingham on 22 June. The display has been compiled by Midland Silicones Ltd. who are planning to take the exhibition to all the big industrial centres in the country in the course of time. Nottingham was chosen as the most appropriate city for the exhibition to make its debut because it was there that Prof F. S. Kipping carried out his research leading to the discovery of silicones. The exhibition will be at the Technical College until 26 June. Invitation cards can be obtained from the sponsoring company whose main offices are at 19 Upper Brook St, London, W.1.

Future plans for the exhibition's travels round the U.K. provide for two more showings before the end of this year and there will probably be four showings in various towns each year. More detailed information will be given at a future date but we understand Manchester and Birmingham will probably be the other two cities chosen for 1954. Manchester is likely to be visited early in October and Birmingham in the latter half of November. An announcement concerning future venues will be made in due course.

Attending Conferences is Waste of Time

THE sending of a representative to the A.P.L.E. conference at Eastbourne next September was criticised at a meeting of Ayr town council last week. Under discussion was whether or not the town's lighting superintendent and one member of the council should represent Ayr at Eastbourne. Treasurer W. S. Lanham (an Englishman incidentally) pointed out that the A.P.L.E.'s was a four-day conference which would cost the corporation about £50, and only six hours at the most was devoted to conference business. Such meetings were not worth while from a Scottish point of view and resolved themselves into a paid holiday for the representatives concerned. The council nevertheless agreed to send their representatives.

CHAS. PARSONS CENTENARY

AN exhibition of the work of the Hon. Sir Charles A. Parsons is being arranged to commemorate the centenary of his birth on 13 June, 1954. It will take place in the Stephenson Building of King's College, Durham University, and will be opened officially at 4 p.m. on 14 June next. The same evening Prof A. F. Burstall will deliver his paper on "The Place of Sir Charles Parsons in the History of Mechanical Engineering."

The First Half-Century

The first annual dinner of the recently-formed National Electrical Manufacturers' Association was held at the Hotel Cecil. The toast list was not very long, and the speakers were for the most part brief, but a programme of music filled up the intervals and accounted for the late sitting. The chairman, Mr Walter Davenport gave the toast of the evening, "Success to the Association," and congratulated it on its first year's work. It had 64 members, and nearly £100 in the Bank. He alluded to the arrangements made with the Contractors' Association, and to the proposal to form local sections.—*From our issue of 19 May, 1904.*

Y.E.B.'s New Industrial Tariff in October

THE NEW industrial tariff originally intended to be introduced by the Yorkshire Electricity Board at the beginning of July, will not now be brought into operation until October, Mr D. Bellamy, Y.E.B. chairman, told the Consultative Council at their meeting last week. The new tariff, which has caused not a little dissension, was eventually approved by the Council, and a clause included in the acceptance, postponing operation until October, because of contract rates already agreed. A review of the tariff after one year was also sought. The Council's special industrial tariff subcommittee recommended a delay in approving the new charges until the Board had produced more statistics to support it. They particularly wanted details of charges imposed on industrial consumers between 1939 and vesting day. Mr Bellamy explained it would take an impracticable amount of time and effort to delve into the records of some 50 private undertakings, and submitted that the result gained would have little value in computing present-day tariff charges. The Board had supplied figures showing that since 1948 there would be increases of 39%, 27·3% and 27% in domestic, commercial and industrial tariffs after all new rates had been introduced.

It was pointed out that about 70% of the Board's costs were represented by the purchase of electricity from the C.A., and the Council had not the opportunity of checking these charges. The Council resolved that a letter be sent to the Minister on the subject and suggesting that a representative of Consultative Councils be a member of the Central Authority in the same way as the chairman of a Council was a member of his Area Board.

Automatic Lighting when Visibility Fades

THE satisfactory illumination of traffic bollards has caused some difficulty in the past, especially at dusk and in bad weather, and an effective solution would undoubtedly assist greatly in the current road safety campaign. Sheffield's road planning policy has included a large number of traffic bollards, and the difficulty of making them visible at all times has been solved by the installation of Radiovisor Mark X street lighting units, operated solely by changes in daylight intensity. The lights are automatically switched on whenever there is a temporary falling-off of visibility. Some years ago now Sheffield embarked on this scheme and ordered 18 control units, but that number has increased considerably until at the present time there are 151 units in operation, controlling some 512 bollards. Most of the bollards house one 100 W or two 60 W lamps. In some cases there are also overhead lamps and these, as well as the bollards, are controlled by the single Radiovisor Mark X.

E.A.W. Study Electricity in Countryside at Torquay

IN ALTERNATE years the E.A.W. hold their annual conference in the provinces and study some particular aspect of electricity. Subject chosen for this year's conference was "Electricity and the Countryside" and what more appropriate locality to study this field than the S. Western Area. Over 500 delegates and visitors gathered at Torquay on Monday for the 1954 conference, the Association's 29th annual meeting.

The S.W. Electricity Board has had a deal of experience in rural electrification, and the background to the whole subject was outlined at the opening of the meeting by the chairman, Mr S. F. Steward. He explained briefly the B.E.A.'s programme saying that it would make great inroads into the problem, resulting in increased prosperity of the countryside and further hope of arresting the drift from the land to industry. Decisions to take electricity to a particular locality would depend on the support received, he said, and ability to carry supplies still further afield would depend on the use made of the service. The basic condition was for all rural consumers to make the fullest possible use of electricity.

Particular aspects of the subject were spoken of by Lady Carew Pole, chairman of the Area's Consultative Council, and by two women with practical experience of farms. The special application of electricity to horticulture was dealt with by Dr Daphne Vince, a lecturer at Reading University. Dr Vince described research work being carried out at the University, and in her address, drew on experiences she had gained from investigations she has carried out in California, Holland and Scandinavia.

Social activities included an official welcome by the Mayor of Torquay, an afternoon tea party, a civic reception and dance, and the local E.A.W. branch's party. There were a number of visits scheduled for this afternoon (Thursday), one of which was to the Area Board's new billing centre in Plymouth. Another feature of the conference was the golf competition for the Lady Hughman Challenge Bowl.

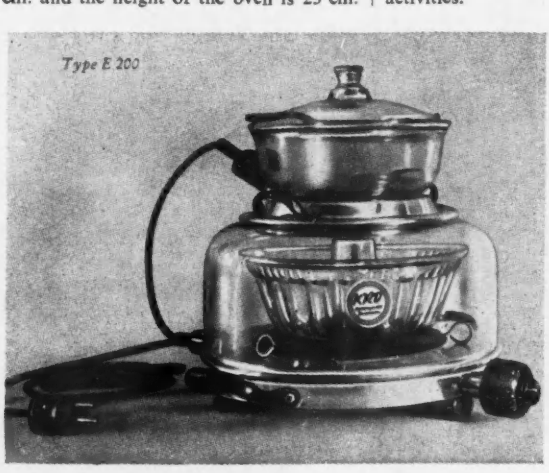
The other six visits should enable the delegates to witness the benefits which electricity has brought to the farm and village; electricity in an agricultural college; and in traditional and modern industry.

Glass Ovenette from behind Iron Curtain

NEWS from Eastern Germany last week included the introduction by the firm of Kurt Roensch in Dresden of a glass oven, suitable for table-top use and capable of cooking, baking, roasting and stewing economically. As can be seen from the accompanying illustration there is an electrically heated bottom plate taking 500 W or 600 W according to the model chosen, forming the base, on which a glass bell is set. There is also a detachable heated upper plate (400 W) which can be utilised at the same time. The glass bell is made of fire-proof Jena Suprax glass. When baking, a special stand sold with the oven, has to be placed on the bottom plate before the pan is placed inside. We understand the appliance is marketed in enamelled, nickelled or aluminium polished models. The glass cover has a diameter of 35 cm. and the height of the oven is 23 cm.

APPRENTICESHIP BOOKLET

YOUNG men contemplating apprenticeships in the electrical industry are well catered for in the supply of information on what is provided for them by the various firms offering such training. Many electrical companies have produced brochures explaining their apprenticeship schemes, and the latest to reach us is that produced by C.A.V. Ltd.; a very handsome booklet it is too. In 30-odd pages the student is introduced to the company, informed of the various schemes offered and the grades to be achieved, as well as told about general terms of employment, conditions, welfare and recreational activities.



The new glass oven being marketed now in Eastern Germany. It is made by Kurt Roensch of Dresden

Power Potential on Solway Firth

A SUGGESTION that the Solway Firth should be surveyed with a view to finding out how quickly and economically a tidal barrage could be built to provide hydro-electric power, was made at last week's meeting of the Annan Professional and Business Women's Club. The idea came from Miss McTurk, former member of the Scottish Reconstruction Committee.

Miss McTurk said millions of units of electricity were wasting their potential on the Solway sands. A tidal barrage across the Solway would provide a capital asset worth many times its cost in twenty years' time.

SAFETY CONFERENCE AT SCARBOROUGH

AS previously reported, the National Industrial Safety Conference, organised by the Royal Society for the Prevention of Accidents, took place at Scarborough last weekend. Over 600 delegates comprising safety and welfare officers and executives attended. From an electrical viewpoint, probably the most important paper was that on "The Safe Use of Electricity," presented by Mr S. J. Emerson, H.M. Deputy Senior Electrical Inspector of Factories.

Mr Emerson confined his remarks to the ordinary type of apparatus with which a works engineer deals in his day to day duties. It was interesting to note, he said, that about two-thirds of electrical fatalities occurred at voltages below 250, and about 70% of these were associated with portable or transportable apparatus.

To reduce that list of accidents tools should be regularly and frequently tested, particular attention being paid to the flexible cable and its connections and to the continuity of the earth conductor. To ensure that no individual tools were overlooked, it was important that such inspections and tests should be under control and not haphazard—a record should be kept in the form of a log book or card index. Mr Emerson illustrated his paper by displaying some types of apparatus and a few demonstrations.

Free Choice after 15 Years

FACED with the prospect of council estates being supplied by overhead lines to cut costs, Urmston (Lancs) council has decided to give their tenants freedom of choice between gas and electric cookers. The council thus reverts to a pre-war practice. When wartime shortages made it almost impossible for tenants to buy cookers, the council installed gas appliances. The Electricity Board has warned the council, however, that if tenants were not given the option of buying electric cookers, they would have to defray costs by supplying estates by means of overhead lines. Tenants will in future purchase their own cookers.

CAN PREPAYMENT METERS BOOST SALES?

SOME discussion is taking place among officials of the N. Western Electricity Board concerning the installation of prepayment meters. At present, consumers may have this type of meter installed only if they can prove hardship, because they are more expensive than the more usual meters read quarterly. Representations on the subject have been made recently by the Area's Consultative Council, however, on the grounds that the Board's policy is tending to lose consumers to the gas industry who install prepayment meters on request. It is alleged that housewives are choosing gas cookers instead of electric cookers because of the policy on meters. The relative merits of the different type of cooker do not appear to make any difference.

Free Coat of Paint

STORY is being told at Westerham of the painted lamp standard. It appears that a new and conscientious employee of the S.E. Electricity Board, seeing a shabby lamp-post, decided to paint it. Unfortunately he painted it brown whereas all the other posts were painted silver. The event created a small mystery but the well-meaning "culprit" was eventually traced, and accepting responsibility, the Board repainted the post silver. The parish council incidentally is responsible for painting their own lamp standards. All's well that ends well, however, as the lamp-post is now the best in the parish.

NEWS IN BRIEF

American, Canadian and British scientists and engineers met at Harwell recently to discuss instrumentation problems associated with their atomic energy projects. They later visited British universities for further talks.

Amateur Dramatic section of Siemens Sports Club presented "The White Sheep of the Family" earlier this month. The section's next play in October will be their 21st production.

Glass Manufacturers' Federation has completed the development of 19 Portland Place, London, as a centre for the British glass industry.

Purchasing Officers' Association is holding a Scottish Regional Conference at the Central Hotel, Glasgow, on Saturday (22 May), coinciding with a visit of the National Council for one of its periodic meetings.

Some of the aspects of the proposed commercial television, especially as regards aerials, are explained in a little leaflet prepared for dealers by Aerialite Ltd.

Six TV transmitters, transmission lines, etc., are to be manufactured by Marconi's Wireless Telegraph Co., Ltd., for installation in Denmark.

The 1954 Year Book of the National Smoke Abatement Society has been published. Price 1s.

QUESTIONS IN PARLIAMENT

Export Incentives

REPORTING on the discussions he had in Bonn recently with the W. German Government on trade and finance the Chancellor of the Exchequer mentioned the question of export incentives. He said progress might soon be made with the removal of artificial incentives to exporters, both in trade affecting Britain and Germany and in the general framework of O.E.E.C. His view that that agreement would shortly be reached was based on his awareness that the German Government intended to free rather than restrict their export effort and to abolish the practices of hidden subsidies.

Air Pollution

RAPID progress was being made by the Air Pollution Committee and a further report was expected before the end of the summer, Mr H. Macmillan said last week. He was replying to Mr N. Dodds, who drew attention to the fact that the inquiry was in respect of the December, 1952, disaster in London, and pressed for quicker action.

Smokeless Zones

IT was suggested by Mr E. Popplewell that regulations should be made granting permissive powers to local authorities to establish smokeless zones instead of the present procedure of presenting Private Bills. He asked if it were possible to do something on those lines. Great interest was being taken in the matter and it was necessary that local authorities should have some power. Mr H. Macmillan said he had no statutory powers to prepare regulations. It would require legislation, and consideration of that step would have to await the report of the Beaver Committee. The Minister added that he was only too anxious to help, but without legislation he was powerless.

Atomic Energy Authority

THE Atomic Energy Authority Bill which passed through the Commons a month or two ago was read a second time in the Lords last week. There were a number of references to the generation of electricity by atomic means, in fact early mention was made by the Marquess of Salisbury in his opening address. He said the Authority could, provided it did not make electricity generation its primary business, produce electricity as a by-product of its undertaking and do any necessary work for that purpose. It was not intended that the Authority should use its power to generate electricity except as a by-product of fissile material. He added also that there was no intention of competing with the B.E.A. Electricity would be offered to the electricity undertaking after the Authority's own requirements had been met. Later he admitted that the need for new sources of power in this densely populated island was second to none in the world. Britain could not afford to lag behind, and the Bill provided the framework for a rapid and fruitful advance.

Lord Wilmot thought the proposal ill-timed and unwise. Transfer from the Ministry of Supply would hinder and hamper at a vital stage, the growth of the economic use of atomic energy. On the other hand Viscount Samuel agreed with the decision to take the department away from Government control and the Civil Service. Allowing himself to look into the future, Lord Glyn said it was probable that by 1970 the railways would be operated by local power stations of a breeder type carrying 400 miles of track, thus eliminating the consumption of coal by what was the wasteful method of the ordinary steam locomotive.

Further reference to electric power was made by Viscount Falmouth. He thought the public were being led to believe that there was some development about to come to pass which would make a huge change in the sources of power generation. Unless the advocates of the generation of power on a large scale in the United Kingdom by means of atomic energy were able to bring forward schemes whereby the cost of energy delivered to the grid was considerably lower than coal, there was little chance of seeing a big development in the next 50 years, in this country at any rate. He said there appeared to be a bigger opportunity for power stations operated by nuclear energy overseas.

Inspectors Qualifications

OF the 83 factory inspectors in the entry grade, seven had science qualifications and 61 were arts graduates. Sir Walter Monckton told the House last week when replying to a question by Mr B. Stross. He added, two inspectors had engineering qualifications, and 13 had considerable works experience.

Fuel Consumption Returns

A REDUCTION in the amount of statistical information required from industrial and commercial users of fuel was announced by Mr Geoffrey Lloyd last Friday. He said it was still necessary to have the information from larger consumers but in future 28,000 smaller users would be exempt from making returns. These accounted for about three-quarters of the number of establishments making returns hitherto. Mr Lloyd was replying to Colonel O. S. Crosthwaite-Eyre.

Electricity in Scotland

A FULL report of the committee stage of the Electricity Reorganisation (Scotland) Bill may be found on page 734.

COMPANY ACTIVITIES

IT has been a long road since the war for Mr W. C. Pegley and his Vactric Ltd. But at last he seems to have put the Ordinary shareholders in sight of dividend again after an eight-year lapse. The company incurred heavy losses immediately after the war. But the Treasury helped with loans and advice and the company was gradually pulled round, and brought back to a peace time footing. It has just paid off 3¼ years of Preference dividend arrears, together with the current half-yearly payment, leaving nothing further owing to the Preference shareholders. The latest year ended in March. All the Treasury loans have been discharged and it is hoped to realise on undeveloped land approximately £40,000.

Much credit goes to Sir Arnold B. Gridley and Lt.-Col C. Hardie, joint managing directors, of Southern Areas Electric Corporation Ltd, for their latest results. Profit for 1953 amounts to £284,800 against £265,600 for 1952 and £153,400 for 1951. Since its electricity undertakings were nationalised in 1948 the company had turned to the manufacture of a variety of electrical apparatus. To enter these fields the group has acquired a number of subsidiary companies, which have been dove-tailed to produce what is becoming a first-class organisation. During the process it has wisely kept dividends down. Even on the increased distribution of 5% dividend and 2½% bonus, the company is well within its means. Including further E.P.L. payment the 7½% is covered three times by the net profit of £99,800, and the £1 ordinary shares around par show a useful yield of 7½%.

It is obvious from the 50% increase in the net income of Chloride Electrical Storage Co. to £968,022 that the more stable conditions in the lead market were a big factor last year. In the previous year, losses were incurred in carrying high-priced lead stocks. This time the financial position is much sounder, with a ratio of current assets to liabilities in the proportion of three-to-one. Mr A. W. Browne, the chairman, records that business improved as the year went on, with the last quarter of 1953 showing sales of car batteries almost equal to half the sales of the first nine months. Export orders, too began to improve towards the end of 1953, although taking the year as a whole, the value of batteries shipped abroad fell by 20% despite reduced selling prices.

Despite a slight decline in W. T. Henley's Telegraph Works' trading profits last year, from £1,392,000 to £1,350,000, probably due to a decline in exports, there are good features in the accounts. Group reserves, for instance, have improved from £6,687,000 to £6,978,000. Current assets are down slightly, due to a reduction in stock and expenditure on orders, but cash is up from £769.000 to £940,000. A new item is a Treasury Bill holding of £895,461. Allowing for the doubled capital the 10½% dividend on the Ordinary shows no change.—*From our City Correspondent.*

British Thermostat Co. Ltd.

With a final dividend of 12½% and a bonus of 7½%, the total distribution for the year to 31 Jan. last is 27½% on capital doubled by a scrip issue. For the previous year 35% was paid on the smaller capital. The group profit attributable to the parent company is £198,499 (*£150,097*) after charging taxation and depreciation. It is also proposed to issue one new Ordinary share for every two held, subject to the consent of the C.I.C.

British Vacuum Cleaner and Engrg. Co. Ltd.

The directors have entered into negotiations with John Thompson Ltd. whereby that concern will acquire B.V.C. Industrial Constructions Ltd. Under these arrangements John Thompson Ltd. will pay three times the par value of the shares in B.V.C. Industrial Constructions Ltd. Mr J. J. Hambidge, chairman and joint managing director, states that in addition, the finances of British Vacuum Cleaner will be liquified by a sum of about £400,000 mainly in respect of the substantial amount at present locked up in work in progress in that section. Explaining the heavy decline in profits, he says that the trading results of the Washing Machine section showed a revenue decline equal to the differential in the accounts for 1953. But there is now a marked improvement in the general position. In the first half of the current financial year to date, vacuum cleaner sales are more than twice those of the same period last year, and washing machine sales have moved forward greatly.

Chloride Electrical Storage Co. Ltd.

This company's 1952 experience of incurring losses in carrying stocks of high-priced lead when the metal market price fell considerably, was not repeated last year with the result that the net profit is almost 50% higher. Mr A. W. Browne, the chairman, reports that in the first

Year to Dec. 31	£ Trading Profit	£ Net Profit*	% on Ord. Earned	% on Ord. Paid	Ord Price High	Ord Price Low
1949	2,220,596	750,517	62	12½††	51/7	44/10
1950	2,298,308	842,431	73	15	60/–	45/–
1951	3,320,084	1,175,662	103	15	77/6	57/–
1952	2,326,825	653,656	55	20	63/3	52/6
1953	2,855,115	968,022	40	15‡	49/3	32/3

*Available for parent company.
†Plus 100% capital bonus.
‡Plus 100% capital bonus.

Orders for alkaline batteries are sufficient for six months at the present output rate. Forty per cent of the orders are for export. Minority interest in the group has increased by about £400,000 due mainly to acquiring control of the manufacturing company, Hart Battery Co., in Canada.

W. Edwards and Co. (London) Ltd.

Some of the 4s. Ordinary and £1 Preference shares are to be the subject of a market placing later this month.

Heatrae Ltd.

After charging increased taxation, the net profit of the year ended 28 Feb. is £10,529 compared with £11,464 a year ago. The dividend is again 12½%.

W. T. Henley's Telegraph Works Co.

Although there is a reduction in the trading profit for 1953, compared with the previous year—no doubt the result of fluctuations in metal prices—the net profit is well up because of the lower taxation provision. The directors also report that the subsidiary, Henley's Tyre and Rubber Co. Ltd. has recovered from the setback suffered in the previous year sufficiently to turn the trading loss into a profit, although after bearing depreciation and other charges that company is still not on a profit earning basis. The consolidated stock-in-trade is valued at £4,466,071, which is over £1 million lower than a year ago.

Year to Dec. 31	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1949	1,792,482	600,078	67	20	26/6	21/1
1950	1,675,393	617,446	71	20	25/–	21/–
1951	1,704,401	555,443	64	20	27/6	19/3
1952	1,392,118	406,842	15	13*	20/6	14/4
1953	1,350,003	588,880	20	10½	19/4	15/10

*Plus 100% capital bonus.

Lisbon Electric Tramways Ltd.

The profit for 1953 is £79,249 (*£69,739*). There is a final dividend of 4% making 6½% (*5%*) tax free.

Morgan Crucible Co. Ltd.

It is proposed that 50% of the present "B" Ordinary stock be converted into "A" Ordinary and also the whole of the "C" Ordinary into "A" Ordinary stock.

Power Securities Corpn. Ltd.

The dividend for 1953 is again raised by 1%, making a total this time of 8%. After charging increased taxation, the group net profit for the year ended 31 Dec. last amounts to £155,150 compared with £140,313 a year ago.

River Plate Electricity and Other Securities Corpn. Ltd.

The net profit for the year to 15 Apr. last is £48,409 (*£41,698*). The final dividend is 8% making a total of 12%, against 10% for the previous year.

Wm. Sanders and Co. (Wednesbury)

There has again been a reduction in the trading profit. The figure for the year ended 31 Dec. last is over £10,000 down on that of a year earlier, it will be seen from our table. The considerably increased competition in the particular sphere of this company seems to be the likely cause of the reduction. But financially the firm is very sound. Current assets at the end of December are valued

Year to Dec. 31	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	50,545	19,036	46	40*	—	—
1951	40,848	12,329	31	25	3/5	2/6
1952	36,298	11,997	28	20	3/3	2/6
1953	26,150	7,096	17	15	2/9	2/–

*Plus 200% capital bonus.

at £139,687, of which stock in trade and work in progress accounts for £89,154. Current liabilities only total £38,360, plus capital commitments estimated at £607.

Southern Areas Electric Corpn. Ltd.

For the year ended 31 Dec. last the profit is £284,781, compared with £265,600 for the previous year. After all charges, the net profit amounts to £99,771 (*£82,460*) of which £79,468 (*£26,348*) is dealt with in the accounts of the holding company.

J. G. Statter and Co. Ltd.

Resolutions have been passed authorising the increase of Ordinary share capital from £30,000 to £250,000 in 1s. shares, the capitalisation of reserves and undistributed profits and a bonus issue of 2,400,000 1s. Ordinary shares in the ratio of four for one held.

Telegraph Construction and Maintenance Co. Ltd.

The board has decided to issue 500,000 £1 Redeemable Preference shares, for which Treasury consent has been obtained.

Telephone Rentals Ltd.

For 1953 the group net profit is £219,841, against £239,264 a year ago. The final dividend of 6% makes a total of 10% for the year on capital increased by a scrip issue.

Dividend Declared

Brecknell, Munro and Rogers. Interim of 10% (*same*).

Sayings OF THE WEEK

"If atomic power superseded the ordinary coal-burning power stations, between 40 and 50 million tons of low grade coal now consumed by power stations would be unsaleable" . . . VISCOUNT FALMOUTH, in the House of Lords.

"I have studied the electrical industry and the electrification of 22 countries and I thought I had nothing to learn about rural electrification until I saw the work of the Electricity Board for Northern Ireland" . . . MR H. NIMMO, chairman of the Southern Electricity Board, speaking at Belfast.

"The press has sometimes referred to the Gas Industry as the Cinderella of the fuel industries. Cinderella had to compete with two ugly sisters but she got the prince in the end" . . . SIR HAROLD SMITH, chairman of the Gas Council, speaking at the Advertising Conference.

Electric Supply News

Ballymena

THE Electricity Board for Northern Ireland has appealed against the refusal of the Ballymena Council to allow the Board to place four heavier overhead lines in place of the two existing lines which cross Casement St and Moat Rd. Mr R. Watt, who represented the Council, said it had always been Ballymena's policy to have electric cables for its housing estates placed underground, often at considerable expense. The area was a residential one and it was the Council's contention that the proposed wires would be extremely unsightly. Mr F. A. L. Harrison, Q.C., who represented the Electricity Board, said it was the Board's object to improve the voltage maintenance in Ballymena. Although the proposed lines would be heavier than the existing cables they would not, to any substantial extent, injure the amenities of the district. He said the case brought up the question whether the Board should put all or more of its cables underground. If the Ballymena objection was allowed it might give rise to a number of small appeals of the same type. Mr J. Irons, area manager of the Board, said the difference in cost between the proposed o.h. and underground cable would be £232. The Ministry of Health and Local Government is to give a decision later.

Durham

The following proposals for erecting electrical network, etc., have been received by the County Council from the North-Eastern Electricity Board: 20 kV overhead line to supply Little Stainton; 20 kV overhead line between Hart Moor substation and Seaton Carew Works substation to provide increased supply for the South Durham Steel and Iron Co., Ltd.; 20 kV overhead line to supply the Old Wheatbottom housing estate, Crook; 20 kV line and subsidiary cable for supply to Middlestone Moor housing scheme, Spennymoor; 20 kV overhead line to supply television station at Pontop Pike; 20 kV and l.v. overhead lines and dismantling existing overhead line in connection with supply to Cornsay Village; 20 kV overhead line to Whitton; l.v. overhead line and reconstruction of existing l.v. line and dismantling of existing network in connection with the transfer of network from N.C.B. to Electricity Board at East and Middle Rainton; conversion of existing 3 kV system to 20 kV from Coxhoe Bridge substation, Coxhoe.

Newcastle upon Tyne

The Health Committee of Newcastle upon Tyne has deferred until its next meeting the question of taking legal proceedings against the British Electricity Authority on account of dust alleged to be emitted from Dunston power station on to parts of Newcastle. At a meeting of the Commit.ee it was stated that the Ministry of Fuel had been asked for technical advice on the matter. One councillor said that if the B.E.A. was prosecuted, the Commi.tee would probably lose its case, but the publicity would show that the Committee was doing what it could. Another councillor commented that complaints about the dust nuisance had been received for such a long time that people were beginning to doubt whether the Health Committee could do anything about it.

Peak District

REPORTING on proposed electricity supply schemes in its area, the Development Control Committee of the Peak Park Planning Board has stated that full discussions between the Board, the National Parks Commission and the East Midlands, Midlands, North Western and Yorkshire Electricity Boards regarding overhead lines had not been particularly helpful. At last week's meeting of the Planning Board, Mr D. W. F. Shilton said the discussions did not advance them in any way. Some members had hoped that it might be possible to make a joint approach to the Treasury to get a special allocation of money. He felt that the Electricity Board simply said that no matter what happened, their capital expenditure was unalterable. He was left with the impression that the Electricity Board had made all their plans for years to come and were not going to tolerate someone from outside getting some money which might upset their plans. The Development Control Committee agreed to continue to give close attention to electrical development in the Park and to ask for underground construction where conditions required it.

Lighting Schemes

Hamilton. The T.C. has accepted in principle the conversion of street lighting from gas to electricity. £3,300 is provided in the 1954-55 estimates for such work.

Herne Bay. T.C. propose to convert 90 gas street lamps to electricity at a cost of £3,074.

Northampton. It is proposed to borrow £19,916 for the fourth stage of the street lighting conversion scheme.

Twickenham. T.C. has approved provisional plans for conversion of street lighting in Hampton from gas to electricity.

Watford. Major improvements to street lighting will cost the B.C. £48,215 over five years. Provision for the expenditure of £17,000 is made in the 1954-55 estimates.

INDUSTRIAL MAINTENANCE

A special monthly section of the Electrical Times

Maintenance in the Tobacco Trade

THE BRISTOL FACTORIES OF W. D. AND H. O. WILLS*

PROCESSING tobacco, making it into cigarettes and cigars, and packing it for pipe smokers is essentially a light industrial process, carried out in pleasant working conditions that present no peculiar problems for the electrical maintenance engineer. The difficulties that arise spring rather from the costly nature of the raw material, which is handled after duty has been paid, the cleanliness essential in any such product, and the usual considerations associated with a mass production process.

At the Bristol group of factories of the W. D. and H. O. Wills Branch of the Imperial Tobacco Co., Ltd., electrical maintenance, together with the considerable amount of installation work inevitable in an industry where machine layouts are frequently replanned, is organised under the general control of the branch's electrical engineer, and under the immediate supervision of factory electrical engineers. This article will deal with two groups of factories, which will be distinguished as the No. 1 Factory and as the Raleigh Rd group.

Both groups of factories are mainly concerned with the manufacture of cigarettes, and the principal processes involved are as follows. The tobacco is first conditioned to bring it to the right moisture content to allow it to be worked, and the tobacco leaf is then removed from the centre stalk. After blending operations, the tobacco is shredded to give the familiar fine condition, and is then fed to machines which form it into a paper-encased rod, and cut off separate cigarettes to a high standard of accuracy of length and weight. Finally there are automatic packing operations.

These processes are carried out in multi-storey buildings, sections of which are air-conditioned to preserve the tobacco at the most suitable moisture content. Individually-driven machines are used almost exclusively, with squirrel cage induction motors commonly of 1, 2 and 3 h.p. rating; the majority of motors are by Brook Motors Ltd.

**Branch of the Imperial Tobacco Co., Ltd.*

Electrical Department

At factory level, the electrical work is organised under foremen who are responsible for day to day operations. As will be explained later, besides the usual duties of such a department, there is a generating station to be manned in each factory group. To take the No. 1 Factory first, the full strength of the department is about 40. There are ten electricians, and besides ordinary mates, a certain number (six at present) of what are termed "second class" electricians. These are men who have had mating experience and have earned the opportunity of training for craftsman's status. A motor patrol system, described later, is operated by two motor cleaners, and three men are employed on a somewhat similar lamp cleaning plan.

That there is a considerable amount of installation work has already been mentioned. This is carried out to orders issued by the responsible electrical engineer, after the job has been planned in detail and costed. In this connection, the electrical department has access to the general works drawing office. Close attention to costing is a feature of the electrical section and indeed of all sections of the firm, and detailed time sheets are kept and subsequently charged to specific orders or departments, according to whether the work is a capital extension or a running repair or renewal.

Plant Records

Two main sets of records give the electrical staff details of all equipment in use and in reserve. First of all, there is a card index of motors. Each motor is given an inventory number when it is purchased, and a card is made out against this number. On the card is recorded in addition the make, type, maker's number, the operational details (b.h.p., amps, speed, a.c. or d.c.) and the identification numbers of the bearings. In addition there is provision for recording the history of the motor, including all overhauls, repairs, etc. The motors themselves have a brass plate bearing the appropriate inventory number attached to them.

The other main series of records deals with the distribution system. A logical system of lettering is used to indicate the full route of supply of every board and motor in the radial system employed, and this in turn facilitates the keeping of a simple log of all circuits and cabling. Schedule sheets are drawn up in terms of distribution boards, and for each board, the sheet lists the circuit fed from each way, the size and type cable installed, both incoming and outgoing, the loading, and the board or item of apparatus fed, together with its location. This system is carried out throughout the firm, so that the branch electrical engineer's office, which keeps duplicate schedules, is always in a position to evaluate with some accuracy, what new cabling will be involved in any contemplated extension.

The system of lettering used in the No. 1 factory results in a number such as A1-3 on a final distribution board. This will indicate that the supply comes from section board A (fed, appropriately, by feeder A from the main switchboard in the generating station) through way 1 which in turn feeds sub-board A1. Way 3 of this sub-board feeds the final board, which is the one marked A1-3.

Power Supply

For the purpose of describing the power supply arrangements, the two factory groups need to be considered separately. In both cases, however, there are oil-fired Lancashire boilers which provide a small quantity of process steam and also the heating steam for the factory. Steam for heating is taken from the exhaust of reciprocating steam engines which are coupled to alternators.

In No. 1 factory, there are three sets, two of 375 kVA rating, and the remaining one of 187 kVA rating. Generation is at 420/240 V, three-phase, 50 c/s, and the sets are connected to an o.c.b. switchboard which is split into two sections by a bus coupler. At present the whole of this switchboard, which has inadequate breaking capaciy, is being replaced by more modern equipment.

In addition to the works generating equipment, a public supply is taken, at present at 420 V, but shortly to be at 11 kV and the firm is permitted to parallel one set with this, a valuable economy in the summer when the heating demand is relatively low. The maximum demand actually imposed on the public supply is 1,000 kVA, and the power factor is kept at an average of 0·9 to avoid penalty. In addition to this a.c. plant, there is a "Nevitron" single anode mercury arc rectifier which supplies a d.c. load mainly made up by magnets for removing ferrous impurities from the tobacco at various stages of manufacture, and by the heaters used for sealing the paper on cigarette making machines.

Power factor correction is applied at the power station, and consists at present of four 44 kVA static capacitors. These are controlled by the generating plant attendant. In addition to this the lagging current drawn from the public supply can be adjusted by manipulating the excitation of the works generators.

Inspection of o.c.b. contacts and oil is possible at weekends, and with regular attention, matters do not progress beyond the stage of removing sludge from the oil and renewing sparking contacts and absorption buffers. The capacitors have been largely trouble-free, except for a tendancy for the protecting fuses to be knocked out of their contacts by the shock when the making contactor closes. This has been overcome by fitting a retaining bar along the front of the fuses.

At the Raleigh Rd group of factories, the power demand is somewhat greater, and a significant amount of d.c. power is still required for driving purposes, although this is gradually being eliminated. The public supply for the whole group of factories is taken at 11 kV through two feeders, and is brought into a spacious switchroom split into three sections by brick walls. From this board three 750 kVA, 11 kV/420 V transformers are fed, and these are connected to an extensive 420 V switchboard in the power house.

Steam engines are again employed for works generation, there being one 312 kVA and one 500 kVA set. In addition, there are two small and one large dual mercury arc "Hewittic" rectifiers, giving duplicate separate 500 and 250 V d.c. supplies from a 420 V a.c. input. Finally, there are two diesel engined generators which can be started up in a minute or so, and provide an emergency standby supply of 625 and 250 kVA All generators give a 420 V, 3-ph a.c., 4-wire supply.

Paper insulated cables, steel wire armoured, run from the main switchboard to separate switchrooms in the various factories of the group, and in this case the power factor correction capacitors are installed in these rooms rather than in the power house, but they are controlled manually from the power house.

Distribution

That the distribution system is organised as a radial scheme has been mentioned already. Throughout the system, reliance is placed on graded fuses for protection, current practice being to install h.r.c. types right down to the final sub-circuits. The non-deteriorating qualities and the good discrimination of this class of fuse together with its relatively low fusing factor are the main reasons for its choice, together with its high breaking capacity. In order to ensure discrimination, as far as possible English Electric fuses are used throughout. As a general rule 15 amp final fuses are preceded by 60 amp section fuses which are in turn preceded by 200 amp power board fuses. These wide spacings add to the certainty of discrimination.

So far as cabling is concerned, the general rule in planning installation has been, and is, to leave a good margin for future extensions. Few of the main feeders are fully loaded, and a recent survey has shown that most cables are carrying below 60% of their rated capacity. Although this means that much copper is tied up apparently unproductively, it gives flexibility to the system in terms of ability to accept sizable transfers of loads arising from the replanning of production layout (which experience has shown is not infrequent) without the need to run new main cables. In terms of fuseboards and switches this practice of under-running adds at small extra cost to the overall reliability and freedom from breakdown.

Feeders from the generating stations are controlled by o.c.b.s in the Raleigh Rd Group of factories, and these feeders terminate in factory switchrooms, as has been mentioned already. Each connects via wedge contact links into a busbar chamber which can be connected by further links to the adjacent busbar chamber. This is regarded as a standby facility only, however, and the feeders are normally operated separately. Simplex Monarch 300 amp fuse-switches control p.i.l.c. cables to the section boards. In the No. 1 Factory, the section boards are fed directly from the generating station o.c.b.s.

The busbar chambers mentioned above are provided with indicator lamps across each phase and neutral to indicate when incoming feeders are alive, but not, in general, with any current indication. The feeders are metered in the generating station, and readings recorded in the station log. Switches are inspected at monthly intervals, although no attention is normally required.

From the main section boards, wiring is carried out in v.r.i. cables, frequently run in metal trunking, although a good deal of heavy gauge welded tubing remains. The marking of the boards has been described earlier, but it should be noted that in addition to the lettering, each board bears signs indicating whether it is a.c. or d.c., the voltage if d.c., and the particular phases present if a.c.

Feeds to final distribution boards are generally run in 19/·052 v.r.i. (No. 1 Factory) or in 19/·064 (Raleigh Rd Group), the normal fusing being 60 amps. Standard practice in the Raleigh Rd group is to run final sub-circuits in 3/·029 for lighting, 3/·036 for power up to 2 h.p., and 7/·029 for power above 2 h.p. In all cases, 660 V grade v.r.i. is used up to the final distribution board, but for a.c. circuits, 250 V grade beyond it. Circuits serving motors rated at above 10 h.p. make a numerically small exception to this last practice. The space factor is, however, tending to require the use of p.v.c. insulated cable for final circuits.

The widespread use of trunking is the most noticeable feature of the distribution system in all the factories. It is run suspended on hangers from the ceiling, and is carried along a full line of machines. The separate lengths of trunking are normally welded together, and this is a valuable help in securing good earth continuity. Where bends are necessary in the trunking, these are normally made at right angles and the cables protected against damage by a wooden fillet, or by fibre or lead packing.

The preferred method of dropping from the trunking to a machine is to terminate the v.r.i. in a plug and socket connector, and drop down to the main machine switch in t.r.s. In other cases, however, a more conventional conduit drop is taken, with the v.r.i. taken out of the trunking down to the switch. In a few cases the use of trunking is continued on the machine itself.

The great advantage of trunking is, of course, its flexibility, cables being relatively simply installed or removed. This is of particular value in the changing circumstances of tobacco processing.

Another flexible system, but one less pleasant in appearance and less popular with the electricians is used in some parts of the Raleigh Rd group. This is t.r.s. supported from catenary wires, and run from final fuse boards directly to the machines. It has some obvious advantages but needs attention to ensure that it remains in good condition and that it conforms to the high standard of safety and freedom from fire risk which is set in these factories. This system is gradually being eliminated in favour of the trunking system.

Starters and Motors

There are some 1,000 motors in the No. 1 Factory, excluding single-phase machines in the office block; and over 1,400 in the Raleigh Rd group. The record system used to keep check of all these motors has already been described. Now the details of installation and maintenance have to be considered.

Few motors are above 10 h.p. in rating; most are below 5 h.p. This means that direct on line starting is widely adopted, and, in fact, it is only in sizes in excess of 10 h.p. (larger in the Raleigh Rd group) that the use of rotor resis-

tance starting is considered. The Raleigh Rd group is in the final stages of a change from d.c., but there are relatively few d.c. machines remaining in use.

On all machines, the push-button motor starters are preceded by an isolator. This takes the form of a 30 amp rotary switch, usually mounted integrally with the contactors and located in front of the operator, and painted electrical orange in distinction to the predominantly green colouring adopted for other machinery and control panels. Although the provision of isolators was originally for the protection of the electrician, it has been found desirable to provide the operative with an accessible means of shutting off all electric power, particularly for machinery driven direct from motors without intervening clutch or loose pulley.

The B.T.H. DOC 90 contactor starter has been selected as standard, and experience has confirmed its high degree of reliability, so that relatively little trouble is experienced with contact wear or spring weakening. For cigarette making machines the starter is built into a special panel which incorporates the isolator, stop and start buttons, an inching button, and switches for the 250 V d.c. supply to the heater and magnet. Brook starters are used for fractional h.p. motors, and Watford starters above 7½ h.p.

Prevailing practice is to provide thermal overload trips on all three phases, and to set them light. It has been found that the tripping times as indicated by calibration plates are less constant than is desired, due to varying loadings, temperature conditions, etc. When a new starter is installed, the standing instruction is now that the overloads should be set as low as possible, and then gradually set up until they just do not trip on normal loads. Close setting is advisable to protect against build-up of load due to additions to machinery or changes of speed unknown to electrical personnel. Wherever practicable, starters are arranged so that they cannot be reset by the operator after they have tripped on overload, but require attention from an electrician, who can look for the cause of the trip. Over 7½ h.p., and in special cases such as hoists, magnetic overload trips are used, with silicone fluids in the dashpots.

The comprehensive numbering system that has been mentioned several times is continued down to individual machines. Above the isolator of each machine is a small strip bearing the painted plant number of the motor concerned and the full designation of the electrical path by which it is fed—perhaps A1—3-8, to continue our former example.

A number of stop buttons are provided on most machines, additional to that on the main contactor but one start position only is permitted for each machine. Where necessary interlocks on guards are provided, connected in the contactor coil circuit of the starter. Both "Burgess" micro-break and Allen West quick break switches are used for these interlocks.

Many of the motors still in use are of the protected type, but all new machines are totally enclosed, fan cooled. Motors are usually connected through flexible conduit, and the general practice is to use Compoflex rather than any flexible metallic conduit. The reasons advanced for this choice are superior strength, and an ability to accept sharper bends without failure. The earth continuity wire of the conduit is carefully made off to the tubing in which the conduit terminates, but in addition, a separate earth continuity conductor is run inside the conduit.

Motor Maintenance

There are some 2,400 3-phase a.c. motors connected in the Bristol factories, and the job of keeping them in smooth working order is one demanding a systematic approach. At the heart of the system is the card index and numbering practice already described; at the other extreme is a patrol system by motor cleaners, who go from room to room cleaning the motors externally, and giving them a superficial examination, which includes the lubrication of bearings where this is necessary. If the motor cleaners find anything suspicious about the motor or starter they report it to their electrical foreman, and an electrician is sent to give the motor a more thorough examination. Motor cleaners visit machines about once every three weeks, though there is some variation in this on the basis of experience.

At periods from one and a half to three years, according to type and working conditions, motors are taken off their machines and brought into the electrical workshops for overhaul. This includes blowing-out, examination of bearings and clearances, and standard electrical tests. A special combined blower and exhaust fan is installed in each electrical workshop so that the cleaning can be carried out neatly and any trapped tobacco dust recovered. At the same time as the motors are overhauled, the associated starters are given a close examination.

Now that totally enclosed motors are becoming standard, the period between overhauls is extending. When most machines were d.c., there was much more need for attention. Apart from the usual problems presented by commutator machines, there was the special one that tobacco dust proved abrasive relative to the commutators and brushes. In addition, there was need to give fairly frequent attention to the contacts on face plate starters.

In a typical year something under 1% of all the a.c. motors installed gave trouble to the extent that they had to be sent away for repair, usually rewinding. Causes of trouble are varied, and it is interesting to note that the low setting of overload trips on all three phases is preventing much trouble with single phasing.

There are a few parts of the factories where automatic contactor gear is installed, an example being the tobacco conditioning plant. Here special arrangements are made for maintenance, the contactor gear being given a complete inspection at monthly intervals by an electrician specially trained on the plant.

Other motor gear, such as limit switches, requires relatively little attention. It is found necessary, however, to keep an eye on the effects of painting of machines. This may cause limit switches to stick by jamming protruding spindles.

In connection with the maintenance and installation of equipment, the firm's electrical engineer emphasises the importance of reporting back through factory electrical engineers any adverse experience with equipment, so that the same gear should not be re-ordered.

Portable Equipment

Portable tools and inspection lamps in the Bristol factories in general work at 240 V, and safety precautions centre in testing earth continuity arrangements and the standard of electrical insulation at regular (weekly, monthly or quarterly) intervals. Each item of apparatus and each flexible lead is numbered, and a log is kept of all tests. The earth continuity test involves passing a current of about 30 amps through the earth lead of the instrument to its frame. This is a sufficiently high current to blow out the earth continuity conductor if it consists of a few strands of flexible only. The voltage drop across the lead is logged to give a check on any gradual deterioration.

Socket-outlets for portable tools are provided around the works, and these are controlled by double-pole switches, so that a portable tool can be fully isolated while still plugged in.

One man in each factory is responsible for the testing of portable tools, and his responsibility extends to the checking of electrically powered office machines—in the No. 1 Factory there are some 600 single-phase motors installed for this purpose. For the testing of this office machinery, a portable test set is provided that will pass about 15 amp through the earth continuity conductor. All office machinery is tested in rotation, the period in the morning between the starting time for the factory and for the office staff being used for this purpose.

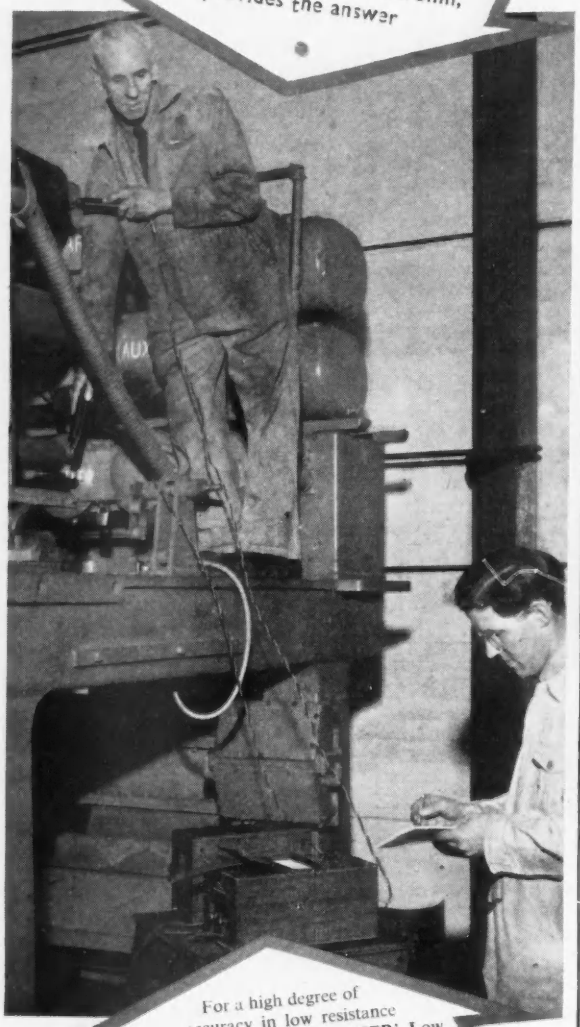
Electric trucks of various types, used for internal transport, may perhaps be included under the heading of portable apparatus. These come into the electrical workshop for general inspection and maintenance once a week.

Lighting

In general, the lighting at Bristol is now fluorescent. The trunking system so widely used has proved readily adaptable to the supply of lines of fluorescent fittings, and the reflectors are normally fixed to the bottom of the trunking, with the control gear situated within the trunking. A more recent modification is to mount the trunking, in effect, upside down, with the fluorescent fitting fixed to the lid, together with its choke. The starter is fixed through a hole in the side of the trunking, so that it is readily accessible without disturbing the whole cir-

'DUCTER' OHMMETERS
FOR LOW RESISTANCE TESTING

When maintenance checks call for low resistance tests—the **'DUCTER' OHMMETER,** accurate down to one microhm, provides the answer



For a high degree of accuracy in low resistance measurements use the 'DUCTER' Low Resistance Testing Set. Designed for testing switch contacts, rail bonds, fuses, armature windings, transformer windings, etc. Being a direct reading instrument it is always ready for use. **SEND FOR PUBLICATION JJ276**

DUCTER TRADE MARK

EVERSHED AND VIGNOLES LIMITED

ACTON LANE WORKS · CHISWICK · LONDON W.4

Telephone: CHiswick 3670 Telegrams: Megger, Chisk, London. Cables: Megger, London.

6/135

MEKELITE

GEARED JOINT

INDUSTRIAL LIGHTING UNITS

Sudsproof head

Where trouble is experienced on machine tools due to suds getting into the lampholder, the sudsproof head with enclosed lampholder can be used instead of the standard head

Various lengths of arm (maximum horizontal reach 54in.). With pillar or short vertical pivot. Six sizes of reflector. Bases for wall, bench, ceiling, floor or for mounting direct on machines. Also portable types.

Catalogue sent free on request.

MEK-ELEK Engineering Ltd.

17, Western Road, Mitcham, Surrey

Telephone: MITcham 3072 Cables: Mekelek, London

PREVENT

SABOTAGE

by Dust and Damp!

WITH

Dust and damp can cause serious breakdowns —particularly in equipment which cannot be brushed out. The answer lies in "Secomak" Portable Electric Blowers—the most powerful obtainable and equally useful as suction cleaners. Model 7 weighs only 10 lb. but delivers air at 340 ft. per sec. Model 70 weighs 15 lb. and delivers air at 425 ft. per sec. with static pressure of 33" w.g.

Secomak REG'D

Portable BLOWING and SUCTION TOOLS

Both models will blow air at temperatures of 200° C. with the "Secomak" Heater Attachment.

Write for Descriptive Leaflets Nos. 101/52ET and 102/29ET

SERVICE ELECTRIC CO LTD

SECOMAK WORKS, HONEYPOT LANE, STANMORE, MIDDLESEX

Telephone: EDGware 5566-7-8-9

cuit. In the latest runs of lighting small screw-in fuses are being tried to protect individual lamps so that a fault on one lamp will not put the whole line out of action and to indicate automatically the faulty unit. Switching is commonly arranged with six 5 ft lamps on one switch.

Lighting intensities are planned according to departmental needs, but generally on a high level. In some instances, a high intensity is sometimes provided overall, so that re-arrangement of machines will not necessitate any alteration in the layout of the lighting.

There is no systematic programme of lamp replacement. In general, blackening of the ends of tubes is looked for as a sign that a lamp is nearing the end of its useful life. Photometer surveys as a standard routine are not made.

In No. 1 Factory, which may be treated as typical in this respect, three men are employed for lamp cleaning and replacement. Two of these men work together, cleaning all the lamps in each department on a rota system, while the other is available for lamp replacements where failures have been reported by work rooms. The three men rotate these duties.

Stores

The electrical department shares with the general engineering departments a well laid-out stores system. All items held as standard stock have maximum and minimum stock limits allocated. A loose leaf system designed to avoid the need for multiple entries records all incoming and outgoing items, and a separate check is kept on orders against specific suppliers to facilitate chasing, and incidentally, to keep a check on service. To avoid unnecessary entries, equipment ordered for a specific installation job, and not being held in stores as stock, is kept out of the general loose leaf system, and is entered in a separate book.

Although most electrical equipment is kept in one section of the general stores, the electrical department maintains its own stand-by motor and starter stores, to which machines are returned after overhaul. In addition, a central motor and starter store houses all motors for which there is no immediate use, and on which any factory can draw.

Acknowledgments

We have to thank the directors of W. D. and H. O. Wills (Branch of the Imperial Tobacco Co., Ltd.) and Mr R. H. Cobbold, Branch Electrical Engineer, for permission to publish this article and for giving assistance in its preparation.

Planning a Works Distribution System

Part 4 Protective Gear and Testing

by a Steelworks Electrical Engineer

SOME observations have been made in preceding articles* on factors having a bearing on the choice of voltage and the method of layout of works electrical networks. The following paragraphs continue the discussion concerning protective gear which was presented in Part 3 of this series of articles.

Busbar Protection

For power station and bulk supply work where busbars are split by section and coupler switches bus zone protection has been developed which will operate in the event of a busbar fault to clear all switches which are feeding current into the point of fault and thus isolate the defective section. Schemes of this nature are far too elaborate for most works systems, but some degree of protection may be considered desirable for a multi-section busbar, and the frame-leakage system can usually be adapted for this purpose. This form of protection depends for its operation on the fact that a busbar fault to earth will cause fault current to flow through the metal framework of the switchgear to the mass of earth. The gear is lightly insulated from earth, and the earth connection to the frame is taken through a current transformer, to which is connected an instantaneous type of relay. A busbar fault to the frame of the gear will energise the relay, which is connected to trip all the switches which can feed current into the affected section of busbar. The bus section switches may be included in zone of busbar protection and should be insulated on one side from the adjacent section of busbar; it is possible for this arrangement to cause mal-operation of the gear in the event of a fault on the spouts of the section switch itself, but the likelihood of such a fault is remote, and can, if required, be covered by auxiliary relays. Fig. 3a illustrates the application of the scheme to a three section switchboard, when three earth c.t.'s are provided, each energising a multi-contact tripping relay which operates the switches feeding fault power into the section. An additional refinement is shown in the form of core balance c.t.'s which are placed over each three-core cable feeding into the gear, connected to auxiliary relays 1, 2 and 3. The tripping circuits are shown schematically in Fig. 3b, which shows that accidental operation of the relays 4, 5 or 6 will not clear the supply switches unless their relays are also closed, i.e. unless the core balance c.t.'s are energised by residual magnetic flux due to the presence of earth fault current in the cables. Fig 3c shows the tripping arrangements if the core balance c.t.'s are omitted; this system is cheaper and less complicated than that of Fig. 3b, but accidental operation of relays 4, 5 or 6 will clear the entire section of busbar protected. The check feature provided by the core balance c.t.'s is, however, really desirable.

The insulation of the framework must be carefully checked, and such items as vent pipes which connect sections of the gear together must have insulating gaskets incorporated to ensure that each section is segregated and clear of earth except for the main earth connection.

Synchronous Plant

The protection of synchronous rotating plant, whether alternators or synchronous motors, offers some difficulty since fault currents will flow into the machine in the event of a winding breakdown or from the machine in the event of a fault on the network to which the machine will supply fault current. In the latter case the machine protection should be slow enough to allow the feeder protective gear to operate first, and the necessary discriminative time interval to be retained. If protection is by I.T.D.M. relays it is not easy to arrive at a suitable setting, because although the initial short circuit current may be 8 to 10 times the full load current, depending on the sub-transient reactance, this current rapidly dies away to the value fixed by the synchronous reactance of the machine, and at the end of the time delay of the relay the current may only be 1½ times full load. If bus zone protection is fitted, a strong case can be made for protecting synchronous plant by the Merz-Price system and omitting back up protection altogether. On works systems the setting required for an I.T.D.M. relay may be low enough to cause operation when synchronising or under short time overload conditions, neither of which require the switch to be tripped, and possibly the best arrangement is to set the relay to clear in the event of a fault in the machine being fed from the busbars.

For plant sizes larger than about 1,000 kW Merz-Price protection is justifiable, and if all six ends of the winding are brought out, as is usually the case, the machine will be covered against phase-to-earth faults and phase-to-phase faults clear of earth. If the neutral is made off inside the machine, protection against phase-to-earth faults only will be provided, but since these are by far the most common and represent the conditions to

**Industrial Maintenance, p. 1, 21 Jan.; p. 21, 18 Feb.; and p. 47, 15 Apr., 1954.*

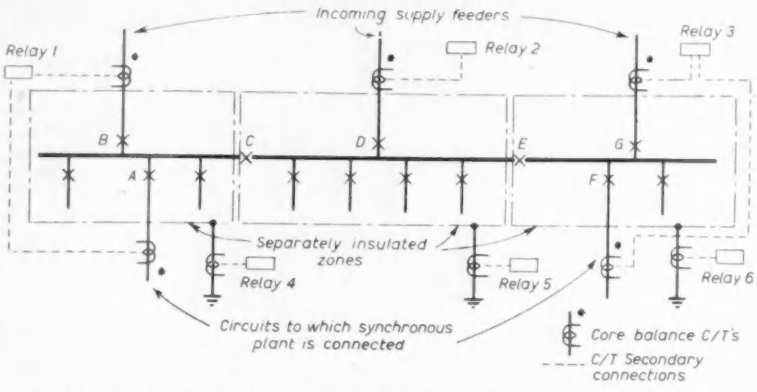
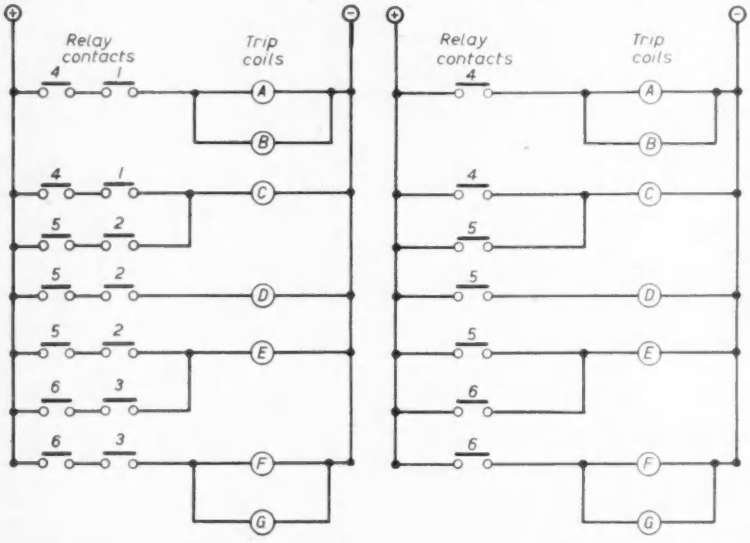


Fig. 3 (a) above, shows a bus zone protection scheme for a three section switchboard, with three earth c.t.'s. Fig. 3 (b) below, left, shows the tripping circuits, which may be alternatively arranged in a simpler way as shown in Fig. 3 (c) below, right



which nearly all faults deteriorate, this is not a major disadvantage. The c.t. arrangements for both cases are illustrated in Fig. 4.

Whatever method of protection be adopted it is essential that the excitation be removed from the rotor by operation of the relay; if this is not done the machine will continue to generate current to supply an internal fault until the winding is destroyed, even if the main circuit breaker has been correctly opened. The tripping arrangements should, therefore, also cover the field suppression switch.

The protection of alternators and synchronous motors differs slightly in that the latter must also be provided with certain devices common to all types of motor, as described below.

Induction Motors

The protection of single-phase and three-phase motors supplied from 400/440 V systems is now practically standardised and usually consists of adjustable time-lag overloads arranged to trip the main contactor and an under-voltage-no-close device to ensure that the motor cannot automatically re-start in the event of restoration of supply after a temporary failure. Thermal overload devices theoretically represent an ideal form of motor protection, since they may be arranged to have a thermal characteristic similar to that of the machine protected. The load which a motor can safely carry is determined by the heating of the windings, and any device which will respond either directly or by analogue to the temperature of the machine would seem a logical form of protection. It is not easy to achieve this in practice, and nearly all motors above 5 h.p. are protected by magnetically-operated overloads, h.r.c. fuses often being fitted as back-up protection and to guard against winding faults.

H.V. motors which start and stop at relatively infrequent intervals are often fed directly from an h.v. circuit-breaker, and some form of current-transformer-operated protection is usually provided. This may consist of a simple overload coil across which a "kick" fuse is connected; when the current exceeds the safe value the fuse blows and all the current flows through the coil. It is difficult t guarantee operation at a fixed value of current due to varying fuse characteristics, and the arrangement lends itself to unauthorised interference which is not immediately detectable. Various types of relay are available which combine thermal overload elements with instantaneous short-circuit elements to give complete protection to the motor. A v.t. will be required to energise the under-voltage no-close circuit.

Slip-ring machines are usually provided with electrical or mechanical interlocks to ensure that the machine cannot be started unless the rotor resistance and the slip-ring short-circuiting gear, if any, is in the correct position.

The protection of d.c. machines follows similar lines, under voltage no-close devices being essential since direct on line starting for d.c. motors is never employed except in the smallest sizes.

Testing Equipment

The absolute necessity for regular testing of protective gear has already been stressed. Apart from the usual portable instruments the special test equipment required includes an accurate time measuring device and some arrangement to inject current either into the current-transformer primary or into the secondary circuit including, of course, the relay.

In order to check completely the function of circuit-transformer-operated protective gear it is necessary to pass current through the primary windings to simulate fault conditions. The magnitude of the current required will depend on the type of gear and the ratio of the current transformers, but will not, in general, need to exceed the current rating of the switch, and in most applications can be considerably less. A transformer with rated secondary output of 5 kVA at 12 V would be suitable, with some form of control on the primary side to vary the injected current. Larger units may be found to be of value but there is always the danger that the equipment will become so unwieldy as to be a white elephant relegated to a corner of the workshop and very rarely used.

An alternative and more convenient method of relay testing is by secondary injection, i.e. by passing current through the relay only. The test set should be capable of delivering up to 40 amp at 6 V and the output should, preferably, be infinitely variable.

A third testing method is available if auxiliary test windings are provided on the current transformers. These tertiary windings are arranged to be operated normally open circuited, and for testing purposes a secondary injection set is connected to the terminals; the primary winding must be open circuited, usually by opening the switch, and the flux produced by the test winding will then induce a corresponding current in the secondary winding and the relay circuit.

An accurate time-measuring unit is essential for checking non-instantaneous relays, and a number of commercial designs are available. A stop-watch mechanism is driven through an electrically-operated clutch, and the watch can

be arranged to start when the injected current is switched on; the opening or closing of the relay contacts will stop the timing mechanism. This method will check the time between the initiation of the fault current and the operation of the relay, thus measuring directly the quantity required. By using the circuit-breaker auxiliary switch in place of the relay contacts the overall clearance time, i.e. relay operating time plus circuit-breaker operating time, may be measured.

Injection Testing Methods

The danger implicit in all forms of protective gear testing is that the connections to the relays may be disturbed during the test and incorrectly replaced on completion. For this reason primary injection is preferable to secondary injection since the disturbance to connections is minimised and with the heavy current connections involved there is less possibility of error in restoring the circuit when the testing gear is removed.

With secondary injection some disturbance to the small wiring is inavoidable since the relay circuit must be interrupted at some point to allow the connection of the test set. I.T.D.M. relays with a plug bridge may conveniently be tested by using a split plug to carry the current from the injection transformer into the circuit under test; the impedance of the c.t. secondary windings is too high to pass the necessary test current unless an excessively high voltage is provided, and a short circuit must therefore be placed across the relay terminals. If a split plug is not used the wiring must be interrupted to connect the test set, and the short circuit placed across the c.t. secondary as before. It is common practice nowadays to provide test links in the c.t. circuits which will allow the short circuiting to be carried out without disturbing the small wiring; this practice is strongly to be recommended.

The use of test windings represents practically an ideal compromise between the above two methods, since the whole of the relay circuit with the exception of the current transformer primary winding, is checked with no disturbance of the wiring. Since the c.t. primary is either wound of heavy section copper or consists of a simple bar, this drawback is not serious. The cost of switchgear fitted with test windings, is, of course, increased, but the principal difficulty may lie in the physical limitations of the gear. With switches already carrying a number of c.t.'s it may prove virtually impossible to provide the additional space required to accommodate the extra windings.

It may be said that primary injection will always give a more thorough and reliable test than the other two methods outlined above. However the facility with which secondary injection can be carried out makes it convenient for routine testing, and this form of test is very widely used.

Protective Gear Testing Routine

It is not proposed to deal in detail with methods of testing specific schemes of protection, and the general problem of commissioning and testing will, it is hoped, in any event be dealt with in a later article. Some general ideas can, however, be considered.

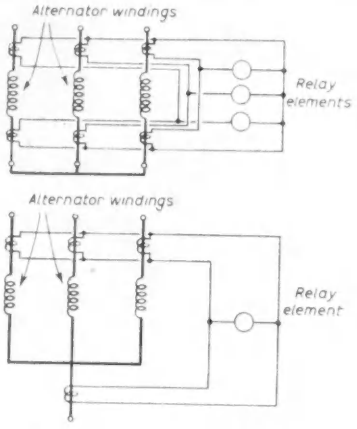


Fig. 4. C.T. arrangements for Merz-Price protection where four and six leads, respectively, are brought out from a generator

Primary injection testing for circuits protected by I.T.D.M. relays only is hardly justifiable, and on first commissioning it will normally be adequate to test by secondary injection, followed by a check on the relay currents when the circuit carries load current. It is common for the relay to consist of two overcurrent elements, connected in the R and B phases of the c.t. secondary, and an earth fault element connected as a residual relay in the connection that joins the two star points. The current in the overcurrent elements should correspond to the actual load current of the circuit, and the current in the earth fault element will be the "spill" due to differences in the c.t. characteristics. For 5 amp c.t. secondaries the spill current should not exceed 5 mA at full load. An open circuit in one of the c.t. secondary connections will cause the whole of the load current to flow in the earth fault element.

Restricted protection for alternators may be conveniently checked by using the alternator itself as a source of primary current. A short circuit may be applied outside the protected zone and the machine excited until full load current or thereabouts is flowing. A check of the c.t. and relay currents may then be made, and in the case of circulating current schemes the latter should not exceed 5 mA. This stability test may be followed by an operation test in which phase-to-phase and phase-to-earth faults are applied within the protected zone, but an adequate check will be obtained if the connections from each c.t. in turn are reversed, a procedure which should operate the corresponding relay element. Here again the necessity for checking that connections are correctly restored must be emphasised.

Similar methods may be applied to transformers if two parallel units are available. By altering the tap-changers a wattless circulating current can be caused to flow due to the difference in ratio of the two transformers. Relay currents can then be checked as before. For transformers which step down to a 400/230 V, 4-wire supply, an earth fault can be applied directly to the l.v. side via a resistance which can consist of an earthed vessel containing the requisite solution of electrolyte sufficient to restrict the fault current to a value where E/F relay will operate; an electrode made up from copper rod and preferably protected by a h.r.c. fuse can be lowered into the electrolyte to simulate fault conditions.

Pilot wire schemes for feeder protection can be tested for operation by a primary injection transformer, but it is not easy to check the schemes for stability unless the feeder is very short; the impedance of an appreciable length of cable will be high enough to prevent the flow of sufficient test current with the voltages available from a test set. If this is so, two injection sets will be required, one at each end of the feeder. Alternatively stability may be checked using load current and measuring the corresponding c.t., relay and pilot coil currents.

All the methods of primary injection require that the set be connected to the two ends of the primary of each c.t. Whilst the switchgear side is readily available the cable side may not be, particularly with metalclad switchgear, and it may be found that tests using load current are the only practicable method.

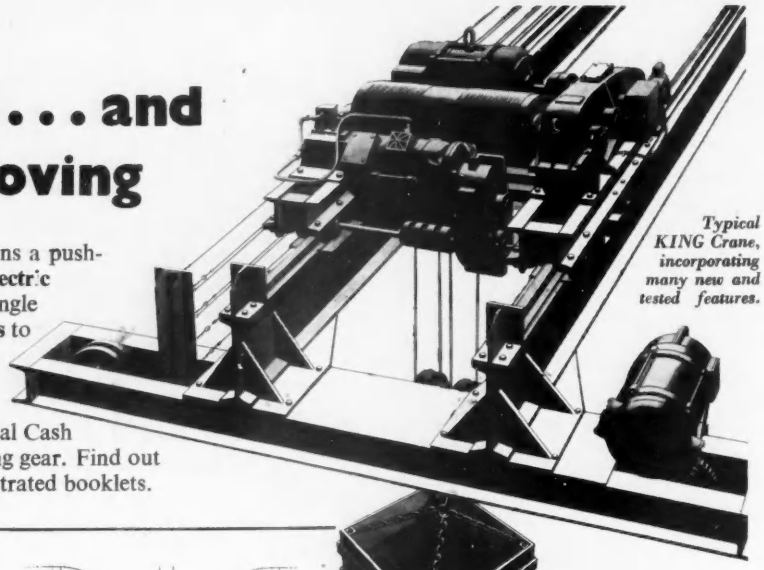
Provided that the terminals of the current transformer secondary windings are accessible, it is possible to check relays by secondary injection whilst the circuit remains alive. The first action in carrying out such tests is to remove the tripping supply links to the switch under test and the necessity for a rigid testing routine is obvious; failure to remove the links and the accidental tripping of the switch during test would be only slightly less distressing than failure to replace the links after the test, which would effectively leave the switch without automatic tripping features at all. The circuit will, of course, be without protection whilst the tests are in progress, but the risk involved is not great. After the trip links have been removed the c.t. may be short circuited and the relay disconnected, if necessary, to carry out the tests. If the c.t. terminals are not accessible from outside the unit the circuit must be made dead to allow the tests to be carried out.

Conclusion

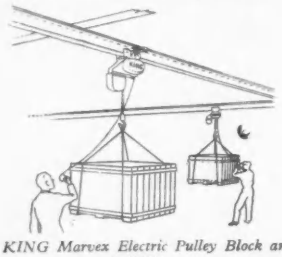
Protective gear may be regarded as a form of insurance investment against the costs of shutdown or of major fault repairs. It is comparatively easy to estimate the cost of the premium, which consists of the capital charges for the gear plus the annual charges for maintenance. It is, however, far more difficult to decide whether the protection offered justifies the expenditure; so far as works systems are concerned it is felt that the influence of the principles obtaining in the supply industry is too strong, and a plea is entered for simplification of protective gear for industrial use.

Call in KING . . . and get things moving

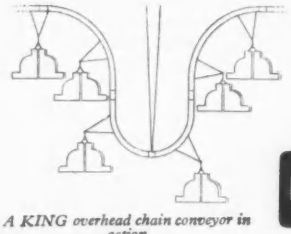
★ **Cranes** to make loads of up to 200 tons a push-button job ★ **Overhead Runways and Electric Pulley Blocks** to lift 100 lbs. to 10 tons, single or double speeds ★ **Overhead Conveyors** to carry from feather-weight up to 1 ton per trolley ★ **Slat, Belt and Roller Conveyors**—to handle ounces or tons ★ Bristol Aeroplane Co., Vauxhall Motors, National Cash Register Co., Electrolux use KING handling gear. Find out how KING can help you — write for illustrated booklets.



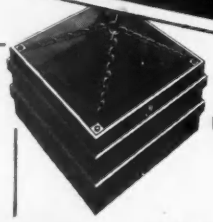
Typical KING Crane, incorporating many new and tested features.



A KING Marvex Electric Pulley Block and runway



A KING overhead chain conveyor in action



KINGS STRENGTHEN YOUR HAND

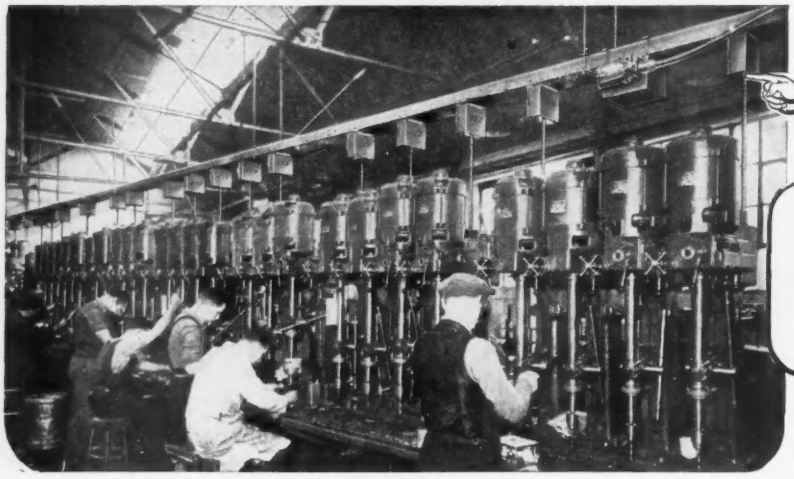
KING

CONVEYORS · CRANES PULLEY BLOCKS

Covered by British and Foreign Patents

Our representative will call on you—anywhere in the world. GEO. W. KING LTD., 40 ARGYLE WORKS, STEVENAGE. TELEPHONE: STEVENAGE 440

RIGHT ON TOP OF ITS JOB!



BUSBAR TRUNKING THE MODERN SYSTEM OF ELECTRIC POWER DISTRIBUTION

Here is Busbar Trunking, the modern method of electrical distribution, in its natural element—an up-to-date machine shop with a close-packed bank of drilling machines. Old ideas of electric wiring have given way to B.B.T.—bare copper busbars enclosed and protected by a steel duct. This trunking is made in 12 ft. lengths, easily extended in any direction; every 2 ft. length there is a tapping point into which the nearest load can be plugged by means of a fused tapping box.

For specifications and prices, write for "Catalogue B.B.T." 102.

ADVANTAGES OF BUSBAR TRUNKING

- **Can be installed in advance, since exact position of machines need not be known.**
- **Motorised machinery can be rearranged at will with the minimum of rewiring and production loss.**
- **Readily extendible to meet additional demands.**
- **Totally enclosed, steel-clad and fire resisting, neat in appearance.**
- **Standard Ratings 175, 250, 300, 400, 500 and 600 amps.**

G. M. ENGINEERING (OTTERY ST. MARY) LTD

1 VICTORIA STREET, LONDON, S.W.1. Tel. ABBEY 5095 Cables: Busbar Sowest London

Crabtree Type B-15 Air-Break D.O.L. Starter

DATA SHEET 5

THE starter as illustrated is a surface mounting unit in keeping with the modern tendency towards making industrial equipment light in weight, pleasing to the eye and efficient in its operation. It is of the air break pattern with thermal type overload control and as no oil is required, even for lubrication, it is especially suitable for use in food and textile factories.

It is designed for use on non-reversing (see below) squirrel cage motors having a range of up to 10 h.p. Three types of case are available as standard: a mild steel case for general use; a cast iron case for heavy duty being weather and dust proof; and a flush mounting for panels and machine tools, in cast aluminium with steel cover. All models can be supplied with isolator in larger cases.

Range of Type B-15 d.o.l. Starters and part numbers. The last three columns apply to complete Starters.

Rating Amp	H.P. (415V 3ph)	Interior only	Overload units	General purpose	Heavy duty	Flush
0·6–1·2	½	16103/3	16003	16103	16103/8	16103/7
1–2	¾	16104/3	16004	16104	16104/8	16104/7
1·5–3	1	16105/3	16005	16105	16105/8	16105/7
2–4	2	16106/3	16006	16106	16106/8	16106/7
3–6	3	16107/3	16007	16107	16107/8	16107/7
5–10	5	16108/3	16008	16108	16108/8	16108/7
9–15	7½–10	16109/3	16009	16109	16109/8	16109/7

General Purpose Starter: weight 4¾ lb, 6¾ in. x 4¾ in. x 4⅜ in. deep approx. Other Spare Parts: Bottom base 16050; Fixed contacts (6)16000/11; Moving contacts (3) 16000/12; Contactor coils to order. 0·2—0·4 and 0·35—0·7A starters also available.

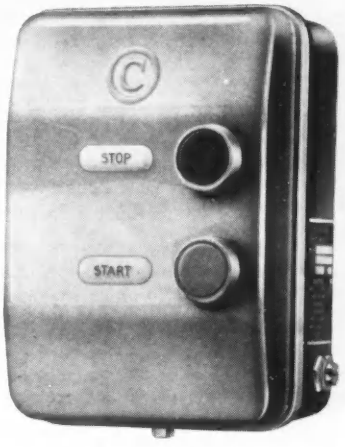
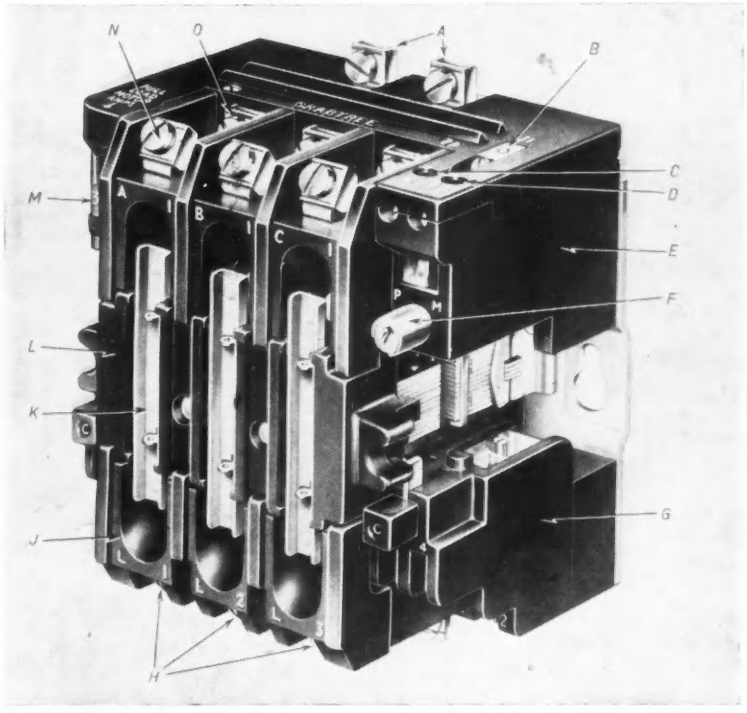
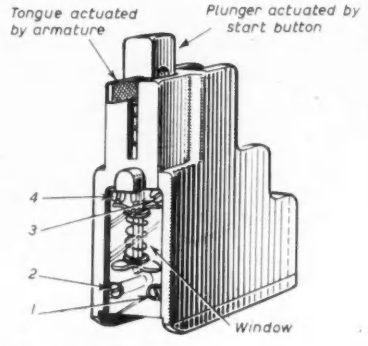


Fig. 1. External appearance of the type B-15 general purpose d.o.l. starter

Fig. 2. The illustration on the right shows the internal construction of the type B-15 starter, and may be compared with the exploded view shown overleaf. Most of the details lettered are referred to in the description of the starter mechanism given below: A—secondary winding terminals. B—terminal for automatic signalling circuit. C and D—terminals for connecting into coil control circuit. E—overload unit. F—resetting selection knob. G—button operated auxiliary contact. H—line terminals. J—bottom moulding. K—moving contact. L—traverse block. M—current setting indicator. N and O—outlet terminals. *Below is Fig. 3.*





Construction

The starter mechanism is extremely neat and compact and embodies a number of new features. The various mouldings are clean, well designed, and exhibit considerable forethought by the designers. Many parts are extremely ingenious, essential mechanism being contained in a very small space.

Basically the starter consists of a resiliently mounted steel back plate on which are fixed three main unit mouldings: (1) On top, the thermal overload unit (2) the magnet assembly and armature (3) the bottom base unit; to which may be added (4) Auxiliary contacts (up to two) operated by main contactor.

All these moulded parts are self contained units, fixing is extremely simple and the various pieces cannot be incorrectly assembled, each being snugged and registered. The back plate is raised to permit cables to pass behind.

The Overload Unit. This compact unit E in Fig. 2 carries three outlet terminals N and three additional terminals O. The terminals O permit the starter to feed two or more contactors or, alternatively, can be connected directly to apparatus and by-pass the overload relay. The overload adjuster is mounted on the left, M. The red plunger F is normally operated by the stop button on the case but when automatic resetting is required the plunger is depressed and turned until the arrow points to M.

The terminal 11 (B) is provided for an automatic signalling circuit indicating when an overload occurs.

Operation. The relay has three heat responsive bi-metal assemblies which have carefully adjusted thermal conditions to match the characteristics of the motor. Compensation is made for ambient temperature. (Fig. 4.)

The overload unit is sealed and must not be tampered with. Figs. 4 and 5 show the internal construction and the operation of the trip. Setting is easily effected by rotating knurled indicator M. The trip contacts can be inspected through a window above the reset plunger. When correctly set a persistent 15% overload will open in 2 hours and a surge of 6 times f.l. current trips in 10 secs.

The Magnet Assembly. This is of normal construction except that the magnets are self aligning and the moving part, the armature or traverse, carrying the contact K, rides on a pair of spring loaded toggles which virtually eliminate friction. The spring serves to keep the armature in the off position and the tension is automatically decreased as the contactor closes. The traction coil has no loose leads, current being fed by silvered phosphor bronze strips engaging appropriate contacts on the coil moulding.

The bottom Base. The moulding (J) bears the three line terminals H, the three silver contactor contacts and the toggles to carry the moving part of the magnet assembly. On either side can be mounted an auxiliary contact unit G containing one normally closed and one open contact. This is illustrated in Fig. 3.

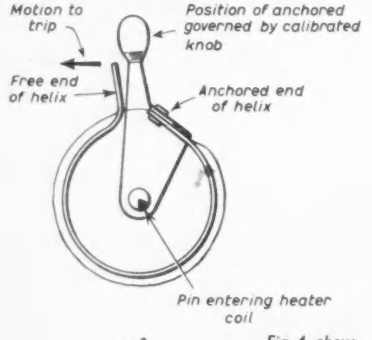
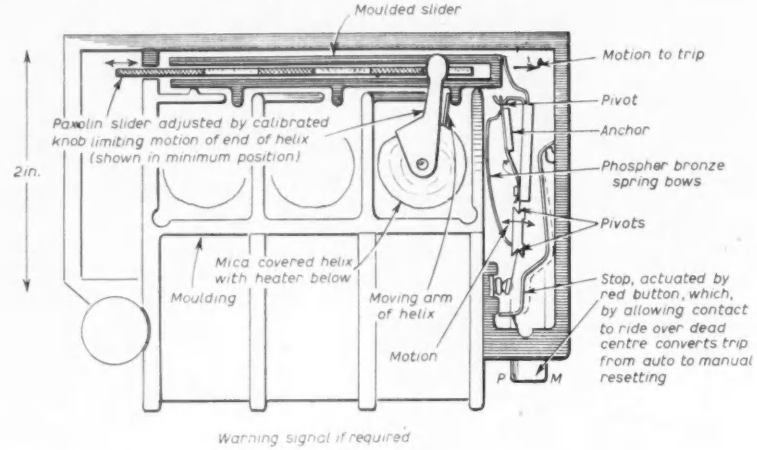
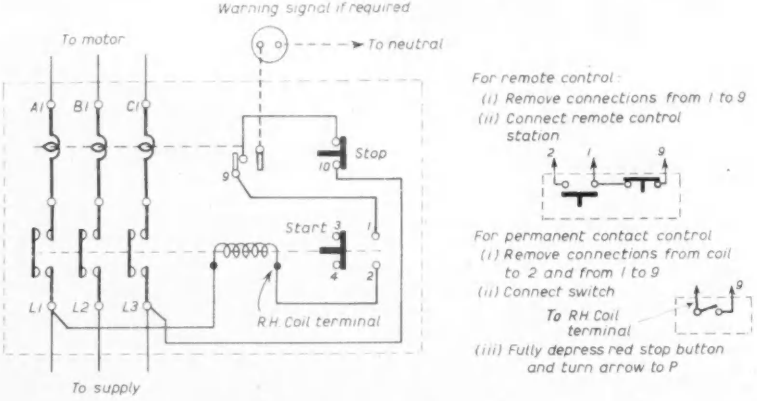

Motion to trip
Position of anchored governed by calibrated knob
Free end of helix
Anchored end of helix
Pin entering heater coil

Fig. 4, above, details of bi-metal assembly seen from below


Moulded slider
Motion to trip
Pivot
Anchor
Paxolin slider adjusted by calibrated knob limiting motion of end of helix (shown in minimum position)
2in.
Phosphor bronze spring bows
Pivots
Mica covered helix with heater below
Moulding
Moving arm of helix
Motion
Stop, actuated by red button, which, by allowing contact to ride over dead centre converts trip from auto to manual resetting
P
M



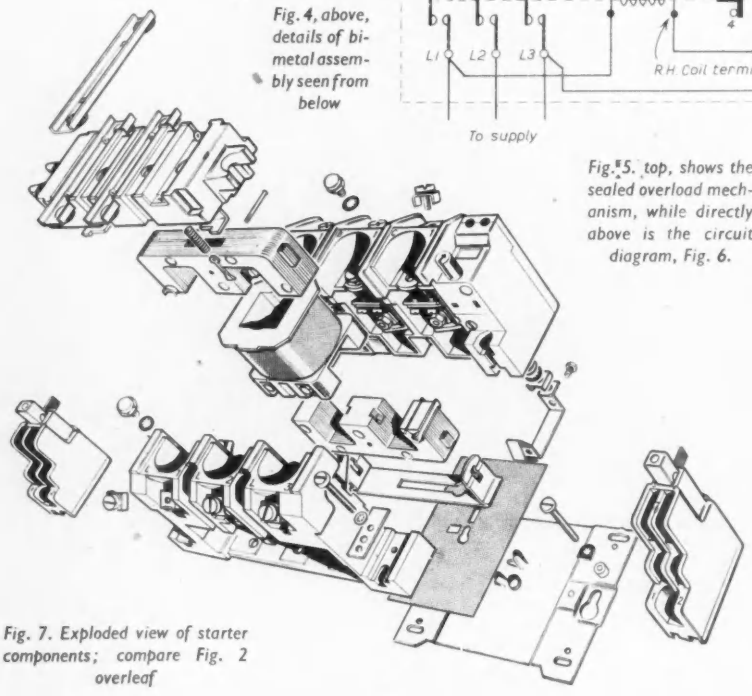


Fig. 7. Exploded view of starter components; compare Fig. 2 overleaf

Fig. 5, top, shows the sealed overload mechanism, while directly above is the circuit diagram, Fig. 6.

Maintenance

The Crabtree B-15 air break starter needs little maintenance. Servicing will consist of replacing worn or damaged parts and the only tools necessary are a screwdriver, a small pair of pliers, and a 2 B.A. box spanner.

Replacing moving contacts K. Each contact bar is held by two spring loaded bayonet pins which when drawn forward and turned 90° will release the part. This will enable the *fixed* contacts to be removed with the 2 B.A. box spanner.

Replacing Magnet Coil. Unscrew the two overload unit fixing screws 7 turns, so permitting removal of armature and giving access to coil.

The bottom unit is held by two screws and the two auxiliary switches G are mounted on this unit, each being fixed with one screw.

No alteration should be made to the thermal overload beyond normal adjusting. Any alteration in the current range will require a new relay.

BUSBAR TRUNKING

A Review of its Advantages and Applications for Industrial Installations

by J. T. WHITEHURST, A.M.I.E.E.

SINCE a well constructed and correctly installed busbar trunking system needs little or no maintenance, the inclusion of an article on busbar trunking under "Industrial Maintenance" may occasion some surprise. Nevertheless, any successful long term maintenance policy must be founded on a decision to employ wherever possible, equipment which will work at top efficiency, year after year, and with a minimum of attention.

Busbar trunking is considered by many to be the best method of distributing electric power in machine shops and other indoor locations where power is required at points not too widely separated. This can be confirmed by comparing the electrical requirements of machine shops with the electrical facilities provided by busbar trunking.

Since modern machinery is equipped with individual electric motor drive, the average machine shop demands an electrical distribution system which provides power points at frequent intervals, and allows electrical connections and extensions to be made quickly and safely. Furthermore, machine shop layouts may be changed from time to time to suit prevailing production requirements, so any really satisfactory system of electric power distribution will allow for the speedy re-arrangement of machines, with the minimum loss of existing cables and conduit, and without shut-down of those machines which are not included in the changeover. It should also be possible to connect new machines without interruption of the electric supply to existing machines.

All the above requirements can be met by busbar trunking. This system, in effect, extends the electric supply mains through the heart of the factory, and provides a ready and safe means of tapping these live mains at frequent and convenient intervals.

Early Installation

It is important to note that busbar trunking can be installed well in advance of motorised machines, and as soon as their approximate position becomes known. It is then ready to give electric supply to incoming machines. Changeovers, and even removal to new premises, can in consequence be carried out with great precision, and with minimum production loss. Needless to say, the system can claim a high recovery value, because it is as easy to dismantle as to assemble. An illustration of this quality is to be found in the considerable quantity of busbar trunking originally installed in the London area which has been moved, with industry, to development areas such as South Wales, Hemel Hempstead and Crawley.

Busbar trunking consists of bare copper busbars housed in a light but rigid totally enclosing steel duct. Tapping points are provided at intervals, usually every two feet, along the entire length of the ducting, and fused tapping boxes can be plugged into these as required. In this manner supply is brought by way of the busbars to positions within easy reach of the electrical load. The load can then be connected by runs of cable in conduit from tapping boxes, which the cable can enter from a side or bottom face.

Standard Lengths

The trunking complete with busbars is made in standard 12 ft lengths. These, together with short lengths, right angle bends, and tee pieces, allow the system to be erected in a variety of ways to suit individual requirements. The installation, consisting as it does of standard components, can be erected speedily, and with the minimum of labour. Since the usual method of mounting the busbars is directly on roof truss members, costly chasing of floors to accommodate conduits is avoided. The amount of conduit and cable required is accordingly reduced to a minimum.

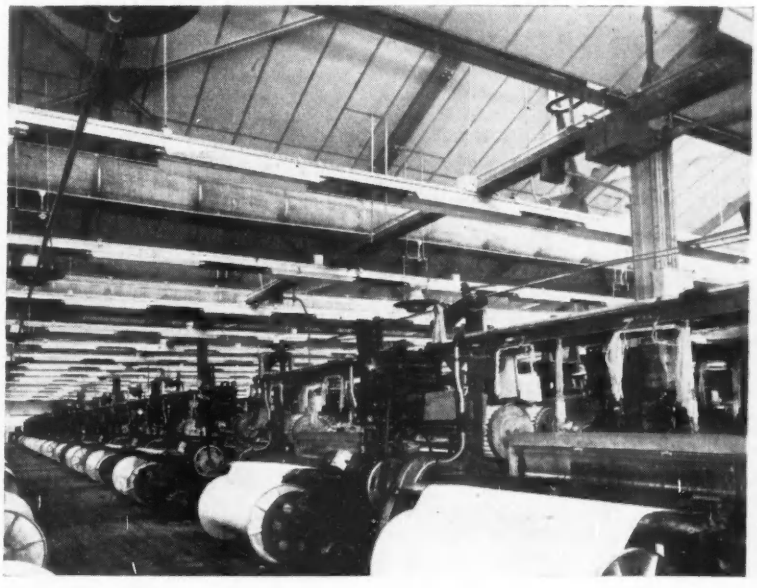
The superiority of a busbar system over other methods of electrical distribution is most marked where there is a high concentration of motorised machines, for apart from speed of installation, operational and long term advantages, there will then be a considerable saving in the first cost of the installation. Concentration of motorised machines may be expressed in terms of horse power per foot run, but it should be borne in mind that this expression does not in itself take into account the installation and operational advantages of the system when compared with other methods. These advantages have led many engineers to choose the system where load density considerations alone might not have justified it.

Textile Installations

Textile installations are usually of a static nature. Quite clearly the automatic looms shown in the adjacent photograph are unlikely to be moved, or re-arranged, for many years to come.

In the case of jute mills, H. M. Nimmo, M.SC., B.E., A.M.I.E.E., gives some very useful information in his article, "Adamjee Jute Mills," which appeared in the ELECTRICAL TIMES, 11 Feb., 1954. Mr. Nimmo's articles is of particular interest to the author since he had the pleasure of meeting him some three years ago in Calcutta and discussing busbar trunking prior to its installation in

Busbar trunking installed in a new cotton weaving shed. Photo by courtesy of Messrs. Tootal, Broadhurst, Lee and Co. Ltd.



**Mr Whitehurst is Sales Manager, G.M. Engineering (Ottery St. Mary) Ltd.*

Busbar trunking installed in a North London press shop

the Adamjee Jute Mills. In his article Mr Nimmo points out that in a textile mill the product is always substantially the same so that, unlike the engineering industry, little re-arrangement or addition of machinery is in prospect. As a result his decision to install busbar trunking was based in the main on first cost. Mr Nimmo goes on to say in regard to first cost: "If the load on the overhead busbars exceeds 2 h.p. per foot, overhead busbars are always justified."

Again, in the case of the nylon industry, Mr B. C. Robinson, after discussing the relationship between spindle speed and horse power, stated at an I.E.E. meeting that where there was 10 h.p. or over per 6 ft run in a line, the overhead busbar system was worth while.

Although considerable reference has been made, above, to machine shops and to the textile industry, busbar trunking is widely employed elsewhere, as for example: aircraft repair hangars, ordnance factories, dockyards, food factories, tobacco factories, oil refineries, laboratories, technical colleges, both at home and abroad.

Since freedom from maintenance worries is dependent in the main on the initial selection of well designed equipment, this article would be incomplete without reference to certain constructional details. The following are important points to bear in mind when purchasing.

(1) A steel clad construction giving complete enclosure provides the best protection against mechanical damage.

(2) Since there is a disparity in the linear expansions of steel and of copper, due to temperature variations:

(*a*) Plug-in contacts, and any fixed connections to the busbars should allow relative movement between themselves and the bars.

(*b*) Busbar expansion joints should be fitted at approximately 150 ft intervals in long runs installed on the straight. For tropical use the distance should be reduced to 100 ft.

(3) The contacts on plug-in tapping boxes and incoming supply cable units must be generously rated.

(4) The metal cases of tapping boxes must be efficiently earthed. This earthing should be carried out in a very definite manner, and contact of the case with the earthing device should be made prior to the plug-in contacts making connection with the busbars. Similarly, when withdrawing tapping boxes the earthing contact must not be capable of interruption prior to the tapping box contacts parting from the busbars.

(5) Provision must be made, so that adjacent lengths and components can be efficiently bonded together to ensure satisfactory earth continuity. In one well-known product, copper straps are provided for bonding one length to another, the screws fixing the straps tapping into the trunking. Care is taken to avoid interference by paint.

(6) Although fire risks are almost negligible, busbar trunking which is air insulated is preferable, from this point of view, to that which has continuous insulation, of some form or another, covering the busbars. Air insulated busbars, too, are least likely to harbour tropical pests. Furthermore, where inspection of the busbars is required, it is more easily carried out, where this type of construction is employed.

(7) Although a good standard finish should be adequate for most conditions of service it is best to galvanise all main steel work and plate all turned parts for tropical use, and for use in a steam laden atmosphere. Adverse conditions of service are best discussed with the manufacturers before a decision is reached.

Sample comparison, it is considered, is always the best method of reaching a decision on relative merits.

CABLE BREAKDOWN

USERS of m.i.c.c. cables may be interested in the following fault attributed to the use of a 660 V m.i.c.c. cable when associated with certain control gear.

Two of the three main fuses protecting the circuit of a 25 h.p. 3-phase squirrel cage motor controlled by a well known make of star delta starter, would occasionally blow for no apparent reason, at the moment when the operator, who was well schooled in the use and abuse of the starter, changed from the "Start" to "Run" position. All possible tests were applied to every part of the circuit but proved negative.

The motor functioned all right for a short spell and it was thought that the trouble had been found, until one morning on starting, the new switch-fuse was blown to pieces. Again every part of the installation was stripped and tested with negative results. The manufacturer of the starter was approached and it was suggested that the No Volt coil in the starter might be causing a high induced voltage to break down the insulation of the m.i.c.c. cable, which incidentally is tested at 3 kV.

Acting upon this suggestion, the cable was thoroughly examined externally for any signs of a breakdown to the metal sheath, but appeared to be perfectly in order. The starter was removed from the circuit altogether and the motor run direct on line using the same cables, and the trouble disappeared.

As a net result of all the tests that have been carried out and the process of eliminating the fault, it has been assumed that: (1) there has been a breakdown of the mineral insulation (magnesium oxide) between the lines of the cable without having any damaging effect on the cable itself; (2) the breakdown occurs at the moment when the change over from star to delta is made; (3) the breakdown is due to a very high inductive voltage in the No Volt coil of the starter; (4) the cure is to fit a voltage surge suppressor across the No Volt coil in the starter.—*J. E. Hooper.*

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

21 May—Edinburgh T.C. Installation in Clermiston North housing development. —See 29 Apr. issue.

21 May—Lossiemouth T.C. Street lighting equipment.—See 13 May issue.

21 May—Sunderland T.C. Installation at Broadway primary school.—See 6 May issue.

22 May—Halifax T.C. Installation in Cross Field bus station.—See 13 May issue.

22 May—Omagh U.D.C. Street lighting scheme at Omagh.—See 6 May issue.

24 May—Stourbridge T.C. Electrically and diesel driven vertical spindle centrifugal pumps at Enville St pumping station.—See 8 Apr. issue.

24 May—West Riding. Rewiring of Ossett Flushdyke and South Elmsall secondary schools.—See 6 May issue.

24 May—West Riding. Rewiring of Shipley Windmill school.—See 13 May issue.

26 May—Durham. Installation in 144 houses at Acre Rigg.—See 15 Apr. issue.

26 May—Roxburgh. Electrical work in nurses' houses at Melrose, Morebattle and Newcastleton. Names by above date to County Architect, County Offices, Newtown St. Boswells.

26 May—Southport T.C. Installations in 96 houses on three estates.—See 13 May issue.

27 May—N. Ireland. Installation at Ballywalter meals kitchen.—See 6 May issue.

28 May—Belfast T.C. Lighting and heating installation at Power Station West. —Advertised in 29 Apr. issue.

28 May—Chertsey U.D.C. Street lighting on three estates.—See 13 May issue.

28 May—N. Ireland. Electrical installation at St. Luke's Hospital, Armagh, for N.I. Hospitals Authority. Documents from Chief Engineer, Victory Buildings, 44 Queen St, Belfast. Deposit £3. 3s.

28 May—Southend-on-Sea. Installation at Westcliff high school, Eastwood Lane.— Advertised in 6 May issue.

28 May—Wortley R.D.C. Installation in 317 houses at Mortomley.—See 6 May issue.

29 May—Mitcham T.C. Group B street lighting along various roads.—See 6 May issue.

29 May—Newcastle-on-Tyne T.C. Installation in aged persons' hostel at Kenton. —See 13 May issue.

31 May—Bromley T.C. Electric wiring of 12 houses on Turpington estate. Property Manager, Municipal Offices. Deposit £1.

31 May—Durham T.C. Supply and erection of (a) 13 250 W mercury vapour lighting units in Sunderland Rd; and (b) 26 250 W similar units in Margery Lane. City Engineer, Town Hall.—Advertised in this issue.

31 May—Bury St. Edmunds T.C. Sodium street lighting units with steel columns. —See 13 May issue.

31 May—Kilkenny T.C. Pumping plant and all accessories.—See 6 May issue.

31 May—Westmeath (Eire). Pumping plant for Tyrrelpass water supply.—See 6 May issue.

31 May—West Riding. Rewiring of Brighouse St. Martin's school.—See 13 May issue.

31 May—West Riding. Rewiring of Featherstone infants' school and Wetherby St. James's C. E. school. County Architect, Bishopgarth, Westfield Rd, Wakefield.

1 June—Keynsham U.D.C. Installation in 124 dwellings on Park West estate.— See 13 May issue.

1 June—Risca (Mon.) U.D.C. Street lighting columns, lanterns and fittings along about five miles.—See 13 May issue.

3 June—Edinburgh T.C. Electrical installation at Hyrot's Bank primary school. City Architect, City Chambers.

3 June—Co Down. Electrical installation in Newtownbreda primary school. Consulting Engineer, A. N. Irens, 58 Howard St, Belfast. Deposit £3 3s.

5 June—Birmingham. Supply of double acting variable speed electrically driven duplex pumps for Tame and Rea Drainage Board. Engineer to Board, Rookery Park, Erdington, Birmingham 24.

5 June—Dublin T.C. Supply of fluorescent fittings for public lighting dept. Finance Dept., City Hall.

5 June—Inverness. Supply of electric lamps during year from 1 July for Craig Dunain Hospital. Secretary of Hospital Board of Management.

7 June—Wolverhampton T.C. Sodium, mercury and fluorescent street lighting.— Advertised in 13 May issue.

8 June—Holland. Installation of electricity in schools at Holbeach St. John's, Pinchbeck East, Wyberton, Weston Hills. County Architect, County Hall, Boston.

8 June—St. Helens. Electrical installation in first phase of Technical College. R. W. Gregory and Partners, consulting engineers, Manchester.—Advertised in this issue.

8 June—Sedgley U.D.C. Supply and erection of 24 concrete columns with 250 W mercury vapour lighting equipment and all necessary gear for class A lighting along Himley Rd. W. M. Jones, engineer and surveyor, The Limes, Dudley Rd. Deposit £2. 2s.

9 June—Maidstone T.C. Rewiring and replacement of fittings in 70 houses on Cherry Orchard estate.—See 6 May issue.

10 June—Belfast T.C. Extension to ash handling plant at Power Station West.— Advertised in 6 May issue.

10 June—Preston T.C. Replacement of installation at Harris Library, Art Gallery and Museum.—Advertised in 13 May issue.

11 June—Portsmouth T.C. Electrically operated air conditioning and gas filtration plant at C.D. Main Control.—See 6 May issue.

12 June—Cuckfield U.D.C. (a) Supply and erection of 38 concrete columns; (b) same of 95 cast-iron columns; (c) supply of 35 pole brackets and supply and erection of 22 wall brackets; (d) supply, erection and wiring of 191 lanterns and lamps. All in group B standard. Surveyor to Council, Oaklands, Boltro Rd, Haywards Heath. Deposit £2. 2s.

16 June—Manchester T.C. Supply and erection at Haweswater of two centrifugal pumps, main switch and motor starting gear, pump control gear, etc. Secretary, Waterworks Office, Town Hall. Deposit £1. 1s.

24 June—Belfast T.C. Supply, erection, etc., of private automatic telephone system comprising exchange equipment, cables and instruments, at Power Station West. Tender N.1520. Merz and McLellan, consulting engineers, Carliol Hse, Newcastle-on-Tyne. Deposit £5. 5s.—Advertised in this issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 115 queries answered this week

Chimney cleaning vacuum cleaners, makers of? G.A.M.—Service Electric Co., Ltd., Secomak Works, Honeypot Lane, Stanmore, Middlesex; British Vacuum Cleaner and Engineering Co., Ltd., Goblin Works, Leatherhead; Sturtevant Engineering Co., Ltd., Southern House, Cannon St, E.C.4; New Welbeck Ltd., 94 New Bedford Rd, Luton; Lamson Engineering Co., Ltd., Hythe Rd, Willesden, N.W.10.

"Electrostrip" paint strippers, makers of? S.B.C.—Falk Stadelman and Co., Ltd., 91 Farringdon Rd, E.C.1.

"Kingston" lamps, makers of? H.T.C.—Kingston Lamp Co., Ltd., 6/12 New Cleveland St, Hull.

Cookers for use with built-in furniture with the same height oven and hotplates, makers of? S.E.B.—C.S.A. Industries Ltd., Wharf St, Warwick.

"Silex" steam irons, repairers of? W.G.M.—J. L. Hoyles and Co., Bigles Rd, Worcester.

"National" vacuum cleaners, address for spares? T.E.—National Utilities Ltd., 8 South King St, Manchester 2.

ANSWER WANTED

Universal micro switches, makers of? G.E.E.

No date stated—N. of Scotland H.E. Board. 132 kV insulator equipment, 32 kV switchgear, etc., for Nairn substation.—Advertised in 13 May issue.

No date stated—Bristol. Supply of electrical stores during 1954-55 for Cossham and Frenchay Hospital Management Committee. Apply to Secretary at Frenchay Hospital.

No date stated.—N. of Scotland H.E. Board. Lighting, heating and small power installation at Invergarry power station. —Advertised in 13 May issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

9 June—Australia. Supply of single-phase distribution transformers (Specif. No. 443) for Townsville Regional Electricity Board, of Electricity Commission of Queensland. Copies of specification available at office of Agent-General for Queensland in London.

11 June—S. Africa. City of Durban invites tenders (E.2460) for supply of three indoor pedestal type, metalclad, compound-filled or air insulated duplicate busbar, 3-phase, remotely controlled 250 MVA switchboards of drawout type. Municipal Buildings, West St, Durban. B.o.T. (Ref.: ESB 10983/54).*

15 June—Australia. Supply of one 700 h.p., 5,000 V, 3-phase, 50 c/s, 1,000 r.p.m. horizontal unity power factor motor and automatic contactor operated starter for Metropolitan Water Sewerage and Drainage Board, Sydney. Tender No. 2658. B.o.T. (Ref.: ESB 11292/54).*

21 June—Saudi Arabia. Supply of telephone cable and accessories for Ministry of Communications, Jedda. B.o.T. (Ref.: ESB 11938/54).*

25 June—Australia. Tenders (No. E14/54) invited by Brisbane's Dept. of Electricity for supply of 75 distribution transformers to various specifications. Documents from Dept.'s Chief Engineer and Manager, Kelvin Hse, Adelaide St, at 10s. 6d. per copy. B.o.T. (Ref.: ESB 11670/54).*

29 June—Morocco. Supply of electrical equipment and h.t. installation of four 5,500 V transformer posts, and installation of l.t. outlets and public lighting of five 5,500 V transformer posts, for Electricity and Water Board of Tangier. B.o.T. (Ref. ESB 11268/54)*.

9 July—Australia. Supply of e.h.t. tongue and clevis disc insulators, l.t. shackle insulators, reel insulators and l.t. rack Insulators, for Brisbane City Council. Chief Engineer and Manager, Department of Electricity, Kelvin Hse, Adelaide St. Spec. No. E12/54. Cost 10s. 6d. per copy. B.o.T. (Ref.: ESB 10007/54).*

15 July—Australia. Western Australia Govt., Murray St, Perth, calling for two tenders (Nos. 143a and 144a) for supply of switchgear. Documents available from Agent General, 115 Strand, London, W.C.2.

9 Aug.—Brazil. Erection and equipping of cold storage depot at Port of Rio Grande. Generator, transformer and compressor units included among refrigeration equipment required. Port Authorities of State of Rio Grande do Sul. B.o.T. (Ref.: ESB 11443/54).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 18 May

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	242	−2	253
„ (3 months)	238½	−1½	—
LEAD, refined pig, min. 99·97% purity (cash)	94½	−⅜	85⅝
„ (3 months)	92⅝	−⅜	83⅝
TIN, refined, min. 99·75% purity (settlement)	722½	+2½	768⅜
„ (3 months)	721	+3½	756¼
ALUMINIUM, ingots 99-99·5%	156	—	161
ZINC, virgin, min. 98% purity (cash)	79⅜	+1½	72½
„ (3 months)	79	+⅜	71⅞
RUBBER No. 1, RSS. spot (per lb)	19½d.	+1d.	21d.
„ c.i.f. basis, ports. July (per lb)	19 5/16d.	+⅜d.	20¾d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52	—	51½
Mild Steel Tape (0·014 in.)	40½	—	40

Contracts Placed

Dudley T.C. Street lamps and equipment for Tansley Hill and Sledmere estates. Revo Electric Co. Ltd., £2,981.

Eccles (Lancs.) T.C. Electrical installation in 306 houses on Brookhouse estate, N. Western Electricity Board, £8,307.

Edmonton T.C. Electrical installation on Flamstead End estate, Holmes and Larkinson, £1,525.

London. Electrical installation at Downham estate extension, Lewisham, London Electricity Board, £7,936; and at Idenda, Hardy and Sylva Cottages, Deptford, Haines and Sheppard Ltd., £3,400.

Nantwich. Improvements to installation at Barony Hospital, Hallams (Electrical Contractors) Ltd., £2,709.

Scunthorpe T.C. Electrical installation in 104 houses on New Brumby and Church Farm estates, H. Hall, £2,860.

Southport T.C. Installation of underground cables in parts of showground, Broughton and Irlam Electrical Engineering Co. Ltd., £1,275.

St. Marylebone B.C. Renewal of electrical circuits in town hall, Higgins and Cattle Ltd., £4,825.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Autamix. 728,344 Class 9. Electric and electronic apparatus and instruments, etc. J. and A. Margolin Ltd., 112/116 Old St, E.C.1.

Bonochord. 727,327 Class 9. Scientific and electrical apparatus, etc. Bonochord Ltd., 48 Welbeck St, W.1.

Conyflux. 727,812 and **Conytherm** 727,813. Cables and insulated wires. Connollys (Blackley) Ltd., Blackley Vale Mills, Blackley, Manchester 9.

Fluorel. In design 716,496 Class 11. Fittings all for lighting installations. Fluorel Ltd., 159 Midland Rd, Leyton, E.10.

Ruston. 722,724 Class 7, Internal combustion turbines, compressors, lighting dynamos and magnetos. Ruston and Hornsby Ltd., Sheaf Iron Works, Waterside South, Lincoln.

Welcap. 727,686 Class 9. Electrical goods and apparatus. Welwyn Electrical Laboratories Ltd., Trading Estate, Bedlington Station, Northumberland.

TRADE NOTES

Merger. The Delco-Remy-Hyatt Division of General Motors Ltd. has been merged with the AC-Delco Division. Communications should now be sent to the AC-Delco Division of General Motors Ltd. at Dunstable, Beds.

Changes of Address. Kent Bros. Electric Wire Co. and E. H. Phillips Ltd. have moved to Kew Works, Broad Lane, Bracknell, Berks, Telephone: Bracknell 881.

Strain and Robertson have moved to 5 Park Circus, Glasgow, C3, the telephone number remaining Douglas 8941/2.

As from 24 May the address of the London Office of British Industrial Solvents Ltd. will be: Devonshire Hse, Mayfair Place, Piccadilly, W.1. Telephone: Mayfair 8867.

New Factory. The Edison Swan Electric Co. Ltd., is to build a new factory at Sunderland which will employ several hundred men and women on the manufacture of cathode ray tubes.

Beama Contract Price Adjustment Formulæ.—*For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 15 May, 1954, shall be deemed to be 150s. 6d.; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry published in the Board of Trade Journal on 15 May, 1954, is 156·7.

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 15 May, 1954, shall be deemed to be 150s. 6d.; (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on 15 May, 1954, are: Materials used in Mechanical Engineering Industries—147·5; "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—143·4. The price of brass condenser tubes, ¾ in. o/d 18 s.w.g. published in *The Metal Bulletin* on 14 May, 1954, is 3s. 6¾d. per lb.

For outstanding Contracts covered by the B.O.T. Intermediate Products Index. For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 15 May, 1954, shall be deemed to be 150s. 6d.; (*b*) "Cost of Material"—the index figure for Intermediate Products published in the Board of Trade Journal on 15 May, is 356.

BUSINESS PROSPECTS

Home

Aberdeen T.C. It is proposed to build infant school at Northfield (£38,176), primary school at Mastrick (£116,081), and infant school at same (£38,176).

Alloa T.C. Dean of Guild Court has approved erection of 30 houses at Kingswell Park.

Brighouse T.C. Construction of 26 dwellings at Rastrick and Southowram. H. A. Sneezum, Borough Engineer and Surveyor, Commercial St.

Bristol. Mecca Dancing Ltd., 76 Southwark St, London, S.E.1, planning to erect dance hall at The Glen.

Broadstairs. T.C. has agreed to erection of factory on Margate-Ramsgate Rd for Craxfords (Ramsgate) Ltd., of Invicta Works, Ashburnham Rd, Ramsgate.

Carlisle T.C. New civic centre to be built on Rickergate site.

Coventry. Veasey and Sharples Ltd., of 416 Stoney Stanton Rd, propose to erect factory and offices in Broad Lane.

Crawley (Sussex). Yates, Cook and Darbyshire, 43 Gt Marlborough St, W.1, are architects for factory and offices proposed at new town by W. Sugg and Co., Ltd.

Cumberland. £97,500 is to be spent on first instalment of Cockermouth secondary school and similar amount on additions to Millom school.

Darlington T.C. Plans approved for factory extensions for Darlington and Simpson Rolling Mills Ltd., and for Chemical and Insulating Co., Ltd.

Derby. Approval given for erection of factory on Osmaston Park industrial estate for Wild and Brown Ltd., Moss St.

Gazette Announcements

COMPANIES ACTS

Electrical Power Specialists (Hendon) Ltd. Creditors are asked to send particulars to liquidator, A. W. Hunter, Walter Hse, 418-22 Strand, W.C.2, by 8 June.

Stewart Automatic Freezers Ltd. Meeting of creditors and members will be held at 12 Marlborough Pl, Brighton, on 14 June at 12 noon and 12.15 p.m. respectively.

J. W. Collins and Sons, Ltd., Hassocks, Sussex. Last day for receiving proofs in respect of intended dividends, 27 May. Liquidator is N. W. Osborne, 11-12 Finsbury Sq, E.C.2.

BANKRUPTCY ACTS

Receiving Order

Tunbridge Wells. Jack C. R. Gillett, electrical contractor of 19 Stangrove Rd, Edenbridge, Kent. Date of order, 11 May.

Intended Dividends

Peterborough. Robert V. Mayner, electrical engineer trading in Narrow St and Wentworth St, Peterborough. Last day for receiving proofs, 28 May. Trustee is C. A. Taylor, Official Receiver, 41 Sidney St, Cambridge.

Dividends

Brentford. Basil F. Robbings, trading as Electric House at 1388 Greenford Rd, Greenford Green, Middx, and as Radio and Electric House at 1b Northolt Rd, S. Harrow. Supplemental dividends of 8¾d. in £ payable at Official Receiver's Office, 58-61 York Terr, Regent's Park, N.W.1.

Ealing T.C. Plans being considered for erection of six shops, 16 flats and 16 maisonnettes on Northholt Park estate.

Edinburgh. Scottish Division of N.C.B. has plans for provision of laboratory in North Gyle Rd, Corstorphine. Cost will be about £50,000.

Elstree (Herts.) R.D.C. Tenders to be invited for erection of 56 houses and six bungalows in Gateshead Rd, Boreham Wood.

Gillingham (Kent) T.C. It is proposed to build about 350 houses at Maidstone Rd Camp, Rainham.

Glasgow. Approval granted to erection of 280 houses in Cadder Rd scheme for Scottish Special Housing Association.

Glendale (Northumb) R.D.C. Permission received to borrow £5,700 for proposed offices at Wooler.

Guildford T.C. Erection of 62 houses and two blocks of flats at Park Barn. Borough Engineer, Municipal Offices, High St.

Halstead (Essex). R.C. Authorities propose to build new church adjoining existing one.

Harlow (Essex). Architect for factory planned by Greaves and Thomas Ltd. is G. Coles, 40 Craven St, London, W.C.2.

Harrogate. H. Webster of 6 Vernon St, Leeds, is architect for factory proposed by Robert Hirst and Co., Ltd., of Bradford, in Hookstone Ave.

Heywood (Lancs). Approval sought for plans for textile factory in Schofield St for J. Ingham, "Moorcroft," Manchester Rd; and for two-storey office block for Mutual Mills Ltd., Aspinal St.

Horwich (Lancs.). J. W. Roberts Ltd. have bought site in Chorley New Rd for new headquarters and research establishment.

Ilford T.C. Construction of civil defence centre at Barkingside. Borough Engineer, Town Hall.

Keighley. Two more storeys to be added to the Keighley Technical College in Cavendish St. Cost estimated at £45,000.

Larne (Antrim) T.C. Plans approved for primary school at Sallagh Park.

Leatherhead U.D.C. Fifty houses proposed for Bramley Way estate, Ashtead.

Lincolnshire. First part (£13,000) of secondary modern school at Crowle to be included in 1954-55 building programme.

London. Factory in Coates La, E.2, proposed by J. Meerloo (Printing Material) Co. Ltd. A. Fieldman, 12 Queen's Sq, Brighton, is architect, and cost will be about £20,000.

Loughborough. Catholic churches to be built in Park Rd, Skelthorpe, and at East Leak. Architects for both are Sandy and Norris, 134 Newport Rd, Stafford.

Lowestoft. Plans approved for erection of proposed college of further education at Denmark Rd. Estimated cost £500,000.

Luton. Tenders soon to be invited for erection of fire station in Studley Rd at cost of about £70,000.

Mansfield Woodhouse. Erection of factory in Leeming Lane South, proposed by Mansfield Shoe Co., Ltd.

Meltham U.D.C. Erection of 24 houses on Helme Lane estate. Council's Architects, P. N. Brown and Son, Market Place, Hanley.

Middleton. Townley Knitting Co. Ltd. to build factory in Green St East.

Newbury (Berks.) R.D.C. Application to be made to borrow £1,988 for electrical wiring of 208 council houses.

Newcastle-on-Tyne. Additional temporary accommodation to be provided at Woolsington airport. Plans also being considered for permanent terminal buildings at airport costing about £120,000.

Ormskirk U.D.C. Erection of 40 houses in Mill Dam Lane, Burscough. Surveyor, Council Offices, Burscough St.

Rochdale T.C. Erection of 78 dwellings on Kirkholt estate. Borough Surveyor, Town Hall.

Peterborough T.C. Tenders may soon be invited for erection of 100 houses on Walton estate. Plans in hand also for further 412 houses on extension to same estate.

Salford. Large factory extensions being planned by Greengate and Irwell Rubber Co., Ltd.

Sheffield. Major scheme in hand for reorganisation of City General Hospital, costing over £400,000.

Stepney. Factory in Bacon St proposed by G. Barker Ltd., 50 New Rd, E.1.

Stirling. Coal Board has approved reconstruction of Manor Powiss Colliery. Estimated cost £1,500,000.

Stockport. Plans submitted for factory and offices in Craig Rd for J. E. Cardwell and Co., Ltd., Balmoral Works, Waterloo Rd.

St. Neots U.D.C. Electricity to be installed in a number of houses.

Stockton-on-Tees T.C. Work will probably start next year on new municipal buildings. First stage estimated to cost £150,000.

Stoke-on-Trent T.C. Application to be made to borrow £45,734 for erection of Blythe Bridge Portland Hse. special school, and £149,389 for Bentilee county primary and infants' school.

Southall (Middx.). It is planned to install electrical services in laboratories and workshops in extensions to Technical College at cost of about £1,705.

Sunderland T.C. Scheme submitted for Lawrence St development involving slum clearance and erection of some 300 flats.

Twickenham T.C. Scheme in hand for erection of theatre on Pope's Garden site in Deep Cross. Cost estimated at £50,000.

Warwick. Addition to Central Hospital, Halton, estimated to cost £48,000.

Washington (Dur.) U.D.C. Detailed plans and estimates to be prepared for block of shops and flats near station.

Welwyn Garden City. Development Corporation's scheme approved for erection of 261 houses and other dwellings at Thistle Grove.

Wigston (Leic.) U.D.C. Development of Lansdowne estate will involve erection initially of 170 houses.

Overseas

Hong Kong. Agency of U.K. maker of ice cream conservators, frozen food cabinets and beverage coolers sought by American Engineering Corpn., Fed., Inc., U.S.A. of 310 Edinburgh Hse, Hong Kong.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

V. G. Selwood (Plant) Co., Ltd., 86 Broomfield Rd, Chelmsford. General agents, brokers, trustees for civil, electrical and general engineers, etc. Nom. cap.: £5,000. Dirs.: Mrs A. L. Collister and Mrs E. I. Collister.

Fieldson's Service Ltd., 307 High Rd, Willesden, N.W.10. Manufacturers of and dealers in electrical goods, including radio and television equipment, etc. Nom. cap.: £2,000. Dirs.: H. M. Davies and E. A. Wilkinson.

Keston Radio and Electrical Co., Ltd. To take over business of radio and electrical dealers and repairers carried on at 67 Croydon Rd, Keston, Kent, by Cyril C. Clarke and Frank H. Pitty. Nom. cap.: £2,000. Permt. dirs.: C. C. Clarke and F. H. Pitty, 71 Croydon Rd, Keston, Kent.

Technicrystal Ltd., 5 Thavies Inn, E.C.1. Physical, chemical and electronic engineers, experts and specialists, etc. Nom. cap.: £12,000. Dirs.: Not named. Subs.: F. Williamson and G. P. G. McNair, 5 Thavies Inn, E.C.1.

J. H. Plotnek Ltd., 47 Wheeleys Rd, Edgbaston, Birmingham 15. Distributors of, agents for, and dealers in, surplus stores and equipment and electrical goods of all kinds, wireless and television sets, etc. Nom. cap.: £5,000. Dir.: J. H. Plotnek.

S.M.F. Co. (London) Ltd. Electro plating, anodising and metal finishing, and mechanical, electrical and general engineers, etc. Nom. cap.: £1,000. Dir.: K. C. Short, 168 Chase Rd, Southgate, N.14.

E. D. Hasberry Ltd. To take over business of radio, television and electrical engineers carried on at Aylesbury by Edward D. Hasberry. Nom. cap.: £12,000. Dirs.: E. D. Hasberry, 22 Manor Dr., Aylesbury, Bucks. (permanent), F. Sale, 11 Northumberland Av, Aylesbury, Bucks. (permanent).

Elston Electric (Brecon) Ltd. Electric and gas engineers, etc. Nom. cap.: £1,000. Dirs.: H. P. Elston and H. E. B. Elston, Priory Grange, Brecon.

T. W. and D. Bray Ltd. Retail shopkeepers, wholesalers, manufacturers of and dealers in electrical, musical and mechanical goods, radio and television engineers, etc. Nom. cap.: £1,000. Dirs.: T. W. Bray and Mrs D. Bray, 83 Somervell Rd, South Harrow.

Electronic Trading Company (Wolverhampton) Ltd., 39 Lea Rd, Wolverhampton. Nom. cap.: £100. Dirs.: to be appointed by subscribers. Subs.: P. S. Hale, 39 Lea Rd, Wolverhampton; and Wendy A. Reynolds, 7 Milford Rd, Walton, Stafford.

Walter Miles (Electrical Engineers) Ltd., 1 Halford St, Leicester. Nom. cap.: £3,000. Dirs: W. G. Miles and Elsie Miles.

Autohops Ltd., 7 Hill Rd, Harrow, Middlesex. Engineers, manufacturers of tools, machines and electronic devices, etc. Nom. cap.: £100. Dir.: Lily Gutman.

Refrigerated Displays Ltd., 84b, New Kings Rd, S.W.6. Refrigeration and cold storage engineers and manufacturers, etc. Nom. cap.: £100. Dirs.: S. V. P. Annis and Betty Annis.

Neoncraft Ltd., 4 Richmond Bldgs, Dean St, W.1. Patentees and manufacturers of and dealers in electrical and neon signs, electric light fittings, etc. Nom. cap.: £2,000. Dirs.: H. C. Madams and Mrs L. E. Madams.

Pearsons Electrical Fittings Ltd., 60 Grafton St, Leeds 2. Nom. cap.: £500. Dir.: G. Pearson.

Bromwest Ltd., Fenwick Hse, 289/93, High Holborn, W.C.1. Manufacturers of and dealers in electrical appliances, clothing, boots and shoes, etc. Nom. cap.: £500. Dirs.: E. Deutsch and F. W. Inns.

H. Greenhalgh and Sons (Auto-Electrical Engineers) Ltd., 95 Leigh Rd, Leigh. Nom. cap.: £1,000. Dirs.: H. Greenhalgh, S. Greenhalgh and T. C. Greenhalgh.

Montefiore Radio and Electrical Stores Ltd., 9 Windlesham Ave, Brighton 1. Nom. cap.: £1,000. Dir.: D. A. Richardson.

Power Insulating Co., Ltd., 13 Lower Green Rd, Esher, Surrey. Nom. cap.: £500. Dirs.: J. H. Boyd and Barbara Boyd.

Power Tool Co. (Willesden) Ltd., 3 Broad St Bldgs, Liverpool St, E.C. Cap.: £100. Dirs.: J. S. Wood and M. G. Waring.

Cleveland Electronic Products Ltd., 6 Broad St Pl, E.C.2. Nom. cap.: £2,000. Dir.: C. V. F. Sheppard.

Dean's Radio and Electrical Co., Ltd., 10 Godstone Rd, Purley, Surrey. To take over business of radio and electric dealer carried on at 187 Chipstead Valley Rd, Coulsdon, by Ernest Dean. Nom. cap.: £4,000. Dirs.: E. Dean, L. G. Scott and A. S. Green.

MEETINGS TO NOTE

THURSDAY, 20 MAY

I.E.E. (London).—Annual meeting at Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Irish).—Annual meeting at Engineers Assoc., 59 Merrion Sq, Dublin.

INSTN. OF CIVIL ENGRS.—"Road Surface as Factor in Street Lighting," A. W. Christie. St. George St, Westminster, 5.30 p.m.

FRIDAY, 21 MAY

I.E.E. (Western).—Summer meeting at Abernant Lake Hotel, Llanwrtyd Wells.

TUESDAY, 25 MAY

I.E.E. (London).—"Owen Falls, Uganda H.E. Development — General Aspects," Sir Charles Westlake, T. A. L. Paton, and R. W. Mountain. Meeting with Civil Engrs., at Great George St, S.W.1.

WEDNESDAY, 26 MAY

INSTN. OF CIVIL ENGRS.—"Owen Falls: Constructional Problems," D. P. Berthin, H. Olivier and Prof C. M. White. Gt. George St, Westminster, 5.30 p.m.

THURSDAY, 27 MAY

I.E.E. (London). — "Development and Utilisation of Hydro-Electric Power in Uganda," J. M. Stock and J. C. Lithgow. Savoy Place, W.C.2, 5.30 p.m.

FRIDAY, 28 MAY

I.E.E. (London Utilisation).—Summer visit.

AUTOMATIC TELEPHONE AND ELECTRIC CO.

ANOTHER SUCCESSFUL YEAR

THE annual general meeting of the Automatic Telephone and Electric Co., Ltd., will be held on June 9 in Liverpool. The following is an extract from the circulated statement of the Chairman, Sir Alexander Roger, K.C.I.E.:

The profit of the Parent Company at £1,086,591 shows an increase of £236,021 over 1952. Taxation at £603,700 absorbs £140,632 more than in the previous year, and represents 55% of the trading profit. The net profit for the year available for appropriation is £95,389 higher at £482,891. In spite of increasingly serious competition in overseas markets and other adverse factors, the results of the year's trading are satisfactory.

Post Office Starved of Capital

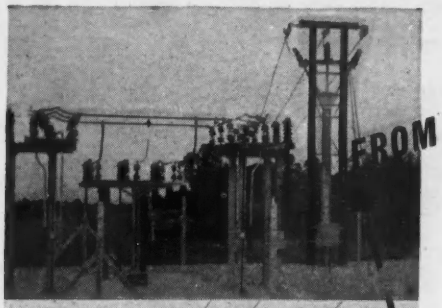
Sales of Telephone Equipment have again been limited by Treasury restriction on Post Office capital expenditure. This policy is depriving the country of a telephone service adequate to its need, and is also denying hundreds of thousands of would-be subscribers facilities for the better transaction of their business and private affairs. It is truly extraordinary that the Post Office, the oldest of the nationalised public utility services, should be starved of sufficient capital to expand a revenue earning telephone service while other nationalised utilities raise the funds they require. If the Treasury is able to exercise such stringent control on the Post Office's telephone expenditure by virtue of the Telephone Service being an integrated part of a Government Department, then there is a strong case for the Telephone Service to be reconstituted as an autonomous public body on the lines of the British Electricity Authority, the Gas Board, and so on. The constitution of any such autonomous body would no doubt be fraught with many difficulties, but that should not stand in the way. Quite apart from any such fundamental change as this, I would seriously advocate that facilities be accorded to the Post Office to raise a loan on the Market specifically for the purpose of financing the development and expansion of the country's Telephone Service.

Sales of Telephone Equipment overseas, although showing some reduction on 1952, have been maintained at a satisfactory level and the industry in general has fought hard to make a notable contribution to British exports.

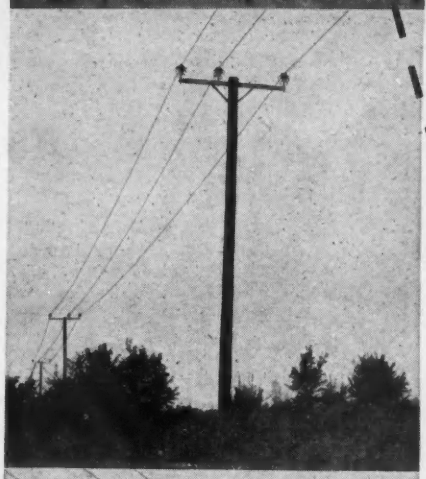
It is vital at this stage in our export trade position that we can look forward to a period of stability—where our efforts to reduce production costs are not nullified by incessant wage claims.

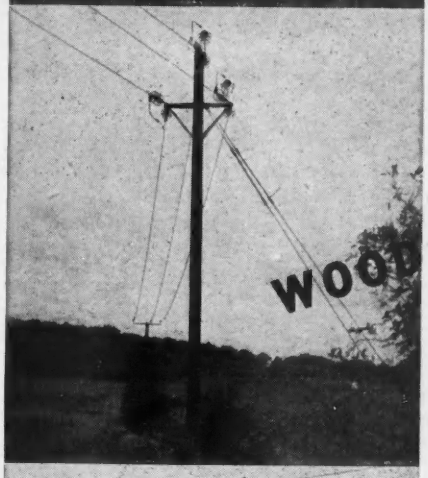
There is ample evidence we have now reached the situation where higher prices will mean loss of business in the export markets. We have long spoken of the growing competition from German, Japanese and other foreign manufacturers.

Industry can only meet increased costs by higher productivity and greater efficiency. Industry in conjunction with the Unions can go a long way along this road, but Government must also play its part. The high cost of Government must be reduced; income tax must be reduced and the value of earnings and savings increased.

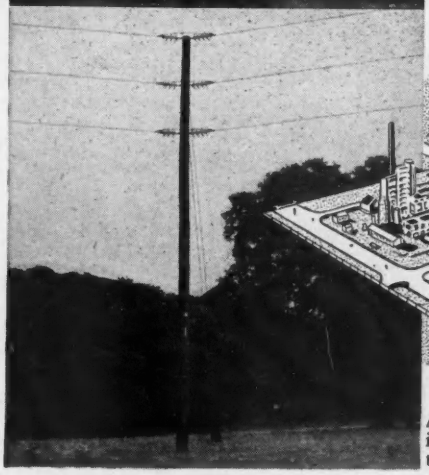


FROM SHORNE





WOO



This 33kV single-circuit, wood pole overhead line was erected by HENLEY Contract Engineers for the South Eastern Electricity Board to supply the Anglo-Iranian Isle of Grain Refinery, Kent. The line, 13½ miles long, is fed from a substation on Watling Street, Shorne.

Generally the conductors are arranged in horizontal formation. They change to triangular formation at light angle poles and to vertical formation at heavy angle poles. To avoid changing from the horizontal directly to vertical and vice versa in a single span, an intermediate triangular formation is adopted.

For any problem concerning overhead lines, concrete, wood pole, and steel tower transmission lines for voltages up to 275kV — call in Henley's.

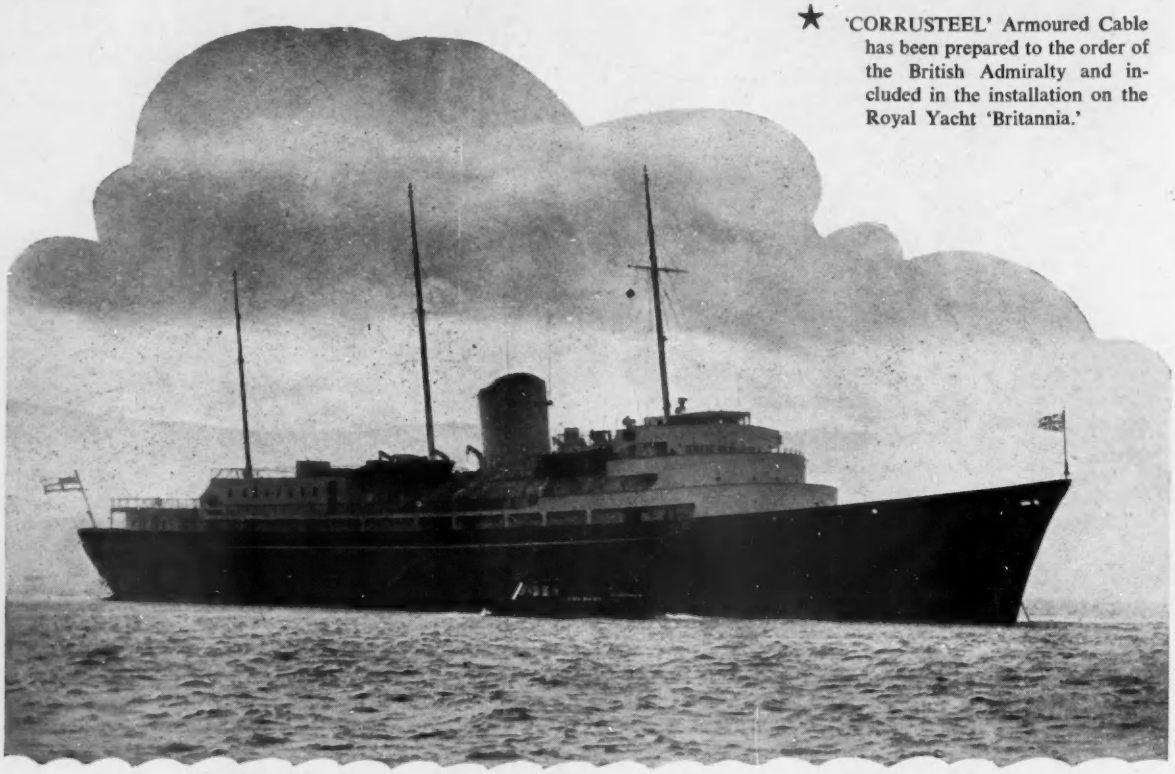
POLE LINES BY HENLEY

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51 - 53 HATTON GARDEN, LONDON E.C.1.

An impression of the Kent Oil Refinery

"Corrusteel..."

★ 'CORRUSTEEL' Armoured Cable has been prepared to the order of the British Admiralty and included in the installation on the Royal Yacht 'Britannia.'



Crown Copyright

WANDLESIDE CABLE WORKS LIMITED are proud to have been associated with the cable installations on the Royal Yacht 'Britannia,' and announce that a special design of 'CORRUSTEEL' Cable has been provided with a Lloyds Certificate.

'CORRUSTEEL' Cable being lead coated steel is stronger and gives a higher resistance to corrosion than conventional types; in these respects it is superior to Aluminum Sheathed Cables. It is also equally light and easier to install.

'CORRUSTEEL' being lead coated steel, Glands or Joint Boxes can be plumbed by wiping or soldering on the outside of Armour in the conventional manner for standard lead covered cables.

Further enquiries will be welcomed.

WANDLESIDE CABLE WORKS LTD.

106, GARRATT LANE, WANDSWORTH, LONDON, S.W.18

Telephone : BATtersea 2273 (5 lines)
Telegrams : "Wandleside" London
London Office and Stores : 30, Tottenham Street, W.1
Telephone : MUSeum 1838

One of the **FALKS** Group

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

CITY AND COUNTY BOROUGH OF BELFAST
Electricity Department

ELECTRICITY (ESSENTIAL SUPPLIES) ACT (NORTHERN IRELAND) 1954

TENDERS are invited for the Supply, Delivery and Erection at Belfast Municipal Electric Power Station West of:

A private automatic telephone system comprising exchange equipment, cables and telephone instruments. The first section of the installation is required to be completed by Dec., 1954.

Form of Tender (N.1520), Conditions, Specification and drawings, in quintuplicate, may be obtained from Messrs Merz and McLellan, Consulting Engineers, Carliol House, Newcastle upon Tyne 1, on payment of a deposit of Five Guineas, which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the contract document may be obtained at One Guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Private Automatic Telephone System, Electricity Department" and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, so as to reach him not later than 4 p.m. on Thursday, 24 June, 1954.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

EYRE GORDON,
Chairman,
Northern Ireland Joint Electricity Committee.

Chichester House,
Chichester Street, Belfast.
14 May, 1954. (H 776)

CITY OF DURHAM

STREET LIGHTING
SUNDERLAND ROAD AND MARGERY LANE

THE City Council invites tenders for the supply and erection of (a) 13 250 W mercury vapour lighting units in Sunderland Rd, and (b) 26 250 W mercury vapour lighting units in Margery Lane, Durham.

Further details, specifications and site plans may be obtained from the City Engineer, Town Hall, Durham.

Tenders enclosed in plain sealed envelopes and endorsed "Street Lighting" but not bearing any name or mark indicating the sender, must be delivered at my office on or before 9 a.m. on Monday, 31 May, 1954. The Council's standing orders provide that no tenders will be received except those sent in complying with the above direction.

The Council does not bind itself to accept the lowest or any tender.

D. B. MARTIN-JONES,
Town Clerk.

32 Claypath,
Durham.
15 May, 1954. (H 774)

CITY OF BELFAST
Electricity Department

SALE OF OFF SERVICE ELECTRICITY METERS

TENDERS are invited for the purchase of off-service electricity meters.

Form of Tender may be obtained, and the meters inspected, on application at the Electricity Department, East Bridge St, Belfast.

Each Tender, in sealed envelope marked "Tender for Off-Service Electricity Meters, Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 4 June, 1954.

An official receipt must be obtained for each Tender delivered by hand. Tenders sent by post should be registered.

The highest or any Tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
14 May, 1954. (H 775)

ST. HELENS EDUCATION COMMITTEE
St. Helens Technical College

FIRMS wishing to tender for the undermentioned services in connection with the first phase of the new Technical College are invited to submit their names to the undersigned by 9 a.m. on 8 June, 1954.

Firms may submit their names for any or all of the following services, and at the same time should submit evidence of their work on similar types of buildings:

(*a*) Plumbing work, including Hot and Cold Water Services and Gas Services.
(*b*) Central Heating (Low Pressure hot water system).
(*c*) Electrical Installation.

The Specification and drawings for these services have been prepared by R. W. Gregory and Partners, Consulting Engineers, Manchester.

From the names submitted a panel of contractors will be chosen and will subsequently be provided with Plans and Specifications. The successful contractors will be nominated sub-contractors to the General Contractor.

N. F. NEWBURY,
Director of Education.

Education Office,
St. Helens. (H 798)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

LONDON COUNTY COUNCIL

SOUTH-EAST London Technical College, Sept. 1954, ASSISTANT, Grade B, in Electrical Engineering. Should have degree or equivalent qualification and industrial experience. Some teaching experience preferred, salary within Burnham scale £586 by £25—£927 according to age, qualifications and experience. Application forms from Secretary at College, Lewisham Way, S.E.4, for return by 4 June (632). (H 768)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following posts:

JUNIOR ENGINEER—NORWICH GENERATING STATION

Salary Class F, Grade 15, £402—Grade 14 £466 per annum.

The duties of the successful applicant will include assisting in the Control Room on shift and other operation and investigation duties. Preference will be given to applicants who have had previous experience in a Generating Station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

SHIFT CHARGE ENGINEER—GREAT YARMOUTH GENERATING STATION

Salary Class D, Grade 7, £633/£643 per annum.

Applicants should have served an apprenticeship and have reached the standard of the Ordinary National Certificate in Electrical and/or Mechanical Engineering, or its equivalent, and possess experience in the operation in a Generating Station.

ASSISTANT ENGINEER—GREAT YARMOUTH GENERATING STATION

Salary Class D, Grade 9, £561/£578 per annum.

Applicants should possess the Ordinary National Certificate in Mechanical or Electrical Engineering, or its equivalent, and have had previous experience in a Generating Station.

A knowledge of instrument maintenance is desirable and the successful candidate will be required to assist in the preparation of statistics and the keeping of technical records.

Applications stating age, qualifications and experience should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by 29 May, 1954.

W. N. C. CLINCH,
Controller.
(H 754)

METROPOLITAN BOROUGH OF FULHAM
Electrical Engineering Assistant

BOROUGH Engineer and Surveyor's Department. A.P.T. IV/V £580/£670 plus £30 p.a. London Weighting. Previous experience in the design and installation of street lighting essential. Membership of A.P.L.E., I.E.S. or I.E.E. an advantage. Details from Town Clerk, Town Hall, S.W.6. Closing date 1 June, 1954. (H 781)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for appointments as FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER in the undernoted Districts:

Glasgow Sub-Area—Eastern District.
Glasgow Sub-Area—Western District.
Clyde Sub-Area—Paisley/Johnstone District.
Lanarkshire Sub-Area—Coatbridge District.
Lanarkshire Sub-Area—Motherwell District.
Larnarkshire Sub-Area—Uddingston District.
Ayrshire Sub-Area—Ayr/Mauchline District.

The posts are on Class F, Grade 6, of the National Joint Board Agreement. Salary scale—£738/£771 per annum.

Applicants should be Engineers with commercial experience and, preferably, should hold an appropriate engineering qualification.

The appointments are superannuable and may be subject to medical examination.

Forms of application, which may be obtained from the applicant's appropriate Officer or the undersigned, should be completed and returned to the undersigned not later than 11 June, 1954. Applicants should indicate the District or Districts applied for.

J. MEEK,
Secretary.

62 Dalziel Drive,
Glasgow, S.1.
20 May, 1954. (H 734)

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the following positions:

GENERAL ASSISTANT ENGINEERS AND JUNIOR ENGINEER
TECHNICAL DEPARTMENT
S/13.531

Applicants should have had suitable experience of technical work in relation to either protective gear or telecommunications.

Preference will be given to those who either possess qualifications and experience admitting to corporate membership of a recognised professional institution, or who are studying for the examinations of such an institution.

Salary: General Assistant Engineers, N.J.B. Class AX/CX, within Grades 6-8, (Grade 6, £584/£765; Grade 8, £501/£675). Junior Engineers: AX/CX Grade 9, £390/£556.

CLERICAL ASSISTANT (STORES)
MARCHWOOD GENERATING STATION
near SOUTHAMPTON
S/13.533

Will be responsible for stores section. Applicants should have a wide experience of stores records and stock control, including certification of invoices, recording of coal consumed accounts, and costing for a large Generating Station.

Salary: N.J.C. Grade 3, £545/£605.

Special application forms for the above posts, obtainable from P. D. A. Oliver, Divisional Secretary, 111, High St, Portsmouth, should be returned by 2 June, 1954.

(H 778)

LONDON COUNTY COUNCIL

SOUTH East London Technical College, Sept. 1954, ASSISTANT Grade B in Electrical Engineering with industrial experience in Electronic or Telecommunication Engineering and/or ability to offer Engineering Drawings as a subsidiary. Salary within Burnham Scale, £526 x £25—£927 according to age, qualifications and experience. Application forms from Secretary at College, Lewisham Way, S.E.4, for return by 5 June. (604). (H 749)

SOUTH EASTERN ELECTRICITY BOARD

SURREY SUB-AREA

SUB-AREA DEMONSTRATOR (FEMALE)

SALARY £605/£665 p.a. under N.J.C. Grade 4. Superannuable. Applicants must have had a good education with subsequent training in Domestic Science and hold the E.A.W. Diploma. The person appointed will be responsible for the training of staff, co-operation with appropriate officers at Sub-Area, policy and planning, exhibitions, agricultural shows, contacts with Education Authorities and women's organisations. Commercial experience and ability to speak in public are essential qualifications.

Applications giving experience and the names of 2 referees to C. W. Hughes, B.SC., M.I.E.E., Surrey Manager, SEEBoard, Rough Rew, Horsham Rd, Dorking, by 2 June, 1954.

DEMONSTRATOR (FEMALE)
MAIDSTONE DISTRICT

Salary £400 by £20 by 10—£490 p.a. under N.J.C. Grade 1. Superannuable. Preference to applicants in possession of a recognised diploma or certificate in domestic science and the E.A.W. certificate. The person appointed will be required to conduct lectures and demonstrations, advise consumers and generally assist in showrooms.

Applications, giving 2 referees to E. E. Pope, M.I.E.E., District Manager, SEEBoard, Fairmeadow, Maidstone, by 2 June, 1954.

JUNIOR CARTOGRAPHIC DRAUGHTSMAN
(MALE) (N.J.C.)
WOKING DISTRICT

Salary £170 at age 16 to £395 at age 26, rising subject to satisfactory service to £470 per annum. Superannuable. Applicants should have a good general education and preferably some drawing office experience.

Applications, giving 2 referees, on forms from J. C. Poole, A.M.I.E.E., Woking Manager, SEEBoard, 4 Chobham Rd, Woking, to be returned by 2 June, 1954.

A. L. BURNELL,
Secretary.
(H 782)

HER MAJESTY'S COLONIAL SERVICE

ASSISTANT ELECTRICAL ENGINEER, MECHANICAL DEPARTMENT EAST AFRICAN RAILWAYS AND HARBOURS ADMINISTRATION

DUTIES are to take charge, under a District Mechanical Engineer, of Electrical Installations in an area which includes a major Port equipped with electric wharf cranes, or to perform the general duties of an Assistant Engineer in the Electrical Section of a Railway.

Appointment is pensionable on probation in the salary scale £650/£1,040 per annum point of entry depending on age, qualifications and experience. A temporary cost of living allowance is also payable at a rate of 35% basic salary with a maximum of £350 per annum. Free passages once each way each tour are provided for the officer, his wife and children up to the cost of one adult passage. Leave is granted at the rate of not less than 4½ days for each month of resident service. Free housing is provided when available.

Candidates between the ages of 26 and 30 should have passed or be exempt from Parts A and B of the examination for A.M.I.E.E. They should have at least 3 years' practical experience in electrical-mechanical work, workshops practice, erection, installation, operation and maintenance of electrical machinery. Test Bed or Drawing Office and electric traction experience an advantage. They should also have held a supervisory position and have administrative ability.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number CDE.173/015. (H 756)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

GENERAL ASSISTANT DISTRICT ENGINEER
WALSALL DISTRICT
WOLVERHAMPTON & DISTRICT SUB-AREA

Applicants should have had experience in all branches of distribution work. Technical qualifications desirable. Salary £466/£486 per annum (N.J.B. Grade F.13). Apply, in writing, within 14 days stating age, qualifications, experience and present position to Mr F. J. Elliott, Sub-Area Manager, Midlands Electricity Board, 83 Darlington St, Wolverhampton.

DEMONSTRATOR (FEMALE)
SHREWSBURY DISTRICT
SHROPSHIRE & HEREFORDSHIRE SUB-AREA

Applicants must have had a good education and should have a certificate of a recognised Domestic Training College and/or the E.A.W. Certificate. Duties include lecture demonstrations in Service Centres and on consumers' premises, and advising consumers on the selection and use of electrical appliances. Salary £400/£490 per annum (N.J.C. Grade 1).

Apply, in writing, within 14 days stating age, education, qualifications, training and experience to District Manager, Midlands Electricity Board, 45 High St, Shrewsbury.

A. STEPHENS,
Secretary.
(H 780)

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Chief Engineer's Department, Meters Section, Ellison Place Testing Station, Newcastle upon Tyne.

(a) GENERAL ASSISTANT ENGINEER
(b) JUNIOR ENGINEERS

Applicants should hold Higher National Certificate in electrical engineering or equivalent qualification and be experienced in the work of Meter Testing Stations.

Salaries: (a) Schedule C, Grade 8, £501/£694. (b) Schedule C, Grade 9, £390/£572. N.J.C. conditions of service.

Applications in writing, stating age, education, qualifications and experience, with details of present appointment, should be forwarded to the Secretary (Establishments), The North-Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (H 767)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

(1) EDUCATION AND TRAINING OFFICER required at the Headquarters of the Board, Electricity House, Love Lane, Liverpool 3. Salary within the range of £1,000/£1,120 p.a. (N.J.C. Grade 9).

Candidates should have experience in the formulation and administration of industrial educational policy and have knowledge of contemporary training methods, including T.W.I. and the national educational system. Knowledge of the various Electricity Supply Regulations will be an added advantage.

The duties of the post will include the preparation and direction of apprenticeships and training schemes for craftsmen, technicians, and professional grades.

(2) ENGINEERING DRAUGHTSMAN (Architectural) required in the Engineering Department at the Board's Headquarters Electricity House, Love Lane, Liverpool 3. Salary within range £433/£567 p.a. (N.J.B. Schedule "D," Grade 6).

Applicants must have experience in building work as applied to industrial or commercial premises and/or reinforced concrete structures and foundations, and should at least have obtained the Ordinary National Certificate or equivalent.

Appointments superannuable and subject to medical examination.

Applications for posts (1) and (2) should be made on forms obtainable from the Establishments Officer at the above address. Closing date: 31 May, 1954.

(3) ENGINEERING DRAUGHTSMAN required in the No. 1 Sub-Area Engineering Department, Liverpool. Salary within the range £433/£567 p.a. (N.J.B. Schedule "D," Grade 6). Appointment superannuable and subject to medical examination.

Applicants should have attained not less than Ordinary National Certificate standard, and have had experience in the preparation of drawings in connection with substation and building construction, layout of H.V. and M.V. switchgear and associated equipment, cables, etc.

Applications for post (3) should be made on forms obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3. Closing date: 31 May, 1954.

(H 755)

THE SOUTH EAST SCOTLAND ELECTRICITY BOARD
Edinburgh Sub-Area

APPLICATIONS are invited for the following positions within the Sub-Area:

SECOND ASSISTANT DISTRICT ENGINEER

Grade F.7, Salary £697/£718 per annum.

The duties will consist of the operation and maintenance of an underground supply system up to 33 kV which includes fault location, protective gear testing, planning and estimating L.V. extensions.

THIRD ASSISTANT ENGINEER
(Planning and Development)

Grade H.10, Salary £641/£667 per annum.

The duties will include the planning and estimating for underground cable networks and substation design up to 33 kV on an underground system. Calculations for fault and load flow current on 6·6 kV and 33 kV systems.

JUNIOR ENGINEERS

Grade H.15 or H.14, Salary £448 or £516 per annum, according to age and experience.

The duties will be assisting in the operation and maintenance of an underground system consisting of L.V., A.C. and D.C. Networks 6·6 kV and 33 kV Systems.

Candidates should have reached Higher National Certificate standard or hold similar qualifications.

The appointments are superannuable and subject to medical examination.

Applications stating age, qualifications, training, experience and present position should be received by the undersigned within fourteen days.

G. T. ALLCOCK,
Sub-Area Manager.

Dewar Place,
Edinburgh, 3. (H 732)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF ARCHITECTURAL ASSISTANT (3RD ASSISTANT ENGINEER) (TEMPORARY), CONSTRUCTION SECTION, CHIEF ENGINEER'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER

APPLICANTS should at least have passed the Intermediate examination of the R.I.B.A. and preference will be given to Associates of this Institute. They must have had experience in the design and construction of modern buildings and be capable of site surveying, preparation of sketch schemes, working drawings and details for large office and depot projects and have some experience of site supervision and contract administration. They will be required to work under the immediate direction of an Architect.

Ability in contemporary design and sound constructional knowledge are essential and applicants should be capable of giving instructions in specification form for the taking off of Quantities.

Salary Scale: £649/£790 p.a. Class AX, Grade 5. N.J.B. Conditions.

APPOINTMENT OF BUILDING AND CIVIL ENGINEERING DRAUGHTSMAN, CHIEF ENGINEER'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER

Applicants should have reached the standard of the Ordinary National Certificate in building and have some practical experience in the design of industrial buildings.

Some knowledge of structural steelwork and surveying would be an advantage.

Salary Scale: £433/£567 p.a. Schedule D, Grade 6. N.J.B. Conditions.

Applications for the above posts to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 29 May, 1954.

APPOINTMENT OF ENGINEERING DRAUGHTSMAN (ELECTRICAL) SUB-AREA TECHNICAL ENGINEER'S DEPARTMENT, MANCHESTER

Applicants should have had a suitable technical education and good Drawing Office training; experience of distribution network equipment would be an advantage.

Salary scale: £433/£567 p.a. Schedule D, Grade 6. N.J.B. Conditions.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (DESIGN AND PLANNING), SUB-AREA TECHNICAL ENGINEER'S DEPARTMENT, MANCHESTER

The duties will involve the design of high voltage substations and adjacent networks and applicants should be able to work on their own initiative and prepare complete working instructions for such schemes, which will involve a sound knowledge of large power networks in city areas.

Applicants should have received technical education up to H.N.C. level or equivalent. Drawing Office experience will be considered an additional qualification, and preference will be given to applicants who are Chartered Electrical Engineers.

Salary Scale: £808/£833 p.a. Grade M.10. N.J.B. Conditions.

Applications for the above posts to Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, by 29 May, 1954.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (MAINS PLANNING AND CONSTRUCTION) SUB-AREA ENGINEER'S DEPARTMENT, OLDHAM

Applicants should have had experience in the planning, construction and operation of large industrial and rural high voltage and low voltage networks including both overhead lines and underground cables and substations, and should be capable of estimating for and supervising the construction of such work.

Salary Scale: £719/£750 p.a. Grade K.10. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 29 May, 1954.

APPOINTMENT OF DISTRICT ENGINEER, CHORLEY DISTRICT

The person appointed will be responsible for matters in the District relating to the operation of H.V. and L.V. o/h and u/g networks and substations and for the general maintenance of supply in the District. Applicants should be capable of supervising constructional work, as may be necessary, and

continued in next column

continued from previous column

keeping essential records of mains and substations equipment. Applicants should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications.

Salary Scale: £1,002/£1,046 p.a. Class F, Grade 2. N.J.B. Conditions.

APPOINTMENT OF ENGINEERING DRAUGHTSMAN, SOUTH-WEST FYLDE DISTRICT

Applicants should preferably have experience in the preparation of building plans, electrical network diagrams, and the layout and construction drawings of substations. The possession of a Technical Certificate in Electrical or Mechanical Engineering will be an advantage.

Salary Scale: £433/£567 p.a. Schedule D, Grade 6. N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 29 May, 1954.

APPOINTMENT OF SECOND ASSISTANT ENGINEER (PLANNING & CONSTRUCTION) SUB-AREA MAINS ENGINEER'S DEPARTMENT, KENDAL

Applicants should have wide experience in the design, survey and construction of overhead and underground transmission and distribution systems with associated substations, operating at pressures up to 33 kV, including rural electrification. Candidates should preferably be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary Scale: £817/£852 p.a. Grade J.7. N.J.B. Conditions.

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER, KENDAL DISTRICT

Applicants should have had experience in planning and estimating schemes and construction, operation and maintenance of both overhead and underground Urban and Rural networks at voltages up to 33 kV. Technical education to H.N.C. standard or equivalent is desirable.

The successful candidate will be expected to undertake standby duties.

Salary Scale: £633/£643 p.a. Grade D.7. N.J.B. Conditions.

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER, WHITEHAVEN DISTRICT

Applicants should have had experience in planning and estimating of schemes and operation and maintenance of both overhead and underground networks at voltages up to 33 kV. Technical education to H.N.C. standard or equivalent with practical experience of overhead line construction is desirable.

The successful candidate will be expected to undertake standby duties.

Salary Scale: £697/£718 p.a. Grade F.7. N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 29 May, 1954.

(H 759)

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

APPLICATIONS are invited for the appointment as DEPUTY STATION SUPERINTENDENT at Kirkstall Power Station, Leeds.

Salary £1,035/£1,081 per annum. Class H, Grade 3, National Joint Board Agreement (Schedule A).

Applicants should have had experience in the operation and maintenance of large modern power station plant including pulverised fuel-fired boilers, have held a position of responsibility involving the control of staff and should be Corporate Members of the Institution of Electrical and/or Mechanical Engineers.

Applications forms obtainable from the Divisional Secretary (Establishments), British Electricity House, St. Mary's Rd, Leeds 7, to be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
(H 779)

ASSISTANT ENGINEER (ELECTRICAL)

required for their London Office by the CROWN AGENTS for Oversea Governments and Administrations. Basic salary scale £650 x £25 to £750 x £30 to £960 x £40 to £1,000 a year plus Extra Duty Allowance of approximately 8%. The £650 minimum is linked to entry at age 25 and is subject to increase at the rate of one increment for each year above that age up to 34. Fully qualified officers at least 27 years old may be eligible for a special increase of £75 after two years' service. Engagement on unestablished terms with prospect of appointment to the established staff and of promotion. Candidates should be between 25 and 35 years of age and have passed the qualifying examination for Associate Membership of the Institution of Electrical Engineers, or equivalent examination. They should have served an apprenticeship or pupilage in electrical engineering with a firm of repute and it is desirable that they should have had subsequent experience of the lay-out of medium sized power stations, diesel and steam driven. A knowledge of consumers installations both industrial and domestic would be an advantage. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/30553/EE.

(H 751)

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

JUNIOR ENGINEERS
BLACKWALL POINT GENERATING STATION
Vacancy No. 54/369

General duties in Generating Station. Class F, Grade 14=£491 p.a.

GENERAL ASSISTANT ENGINEER
THAMES GRID CONTROL AREA, LONDON
Vacancy No. 54/370

Power Station experience an advantage. Successful candidate must be prepared to work shift hours if required. Salary in scale, Class AX, Grade 8=£526. 1s. to £670. 19s. rising to ultimate maximum EX.8 £749. 14s. p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement.

(H 766)

MIDLANDS ELECTRICITY BOARD

Birmingham and District Sub-Area

REQUIRE a PRINCIPAL ASSISTANT in the Engineer's Department. Should have had a wide experience in the administration and clerical work of the distribution side of the Electricity Supply Industry and have a knowledge of personnel matters, stores, invoice procedure, filing, correspondence, engineering statistics, etc. Membership of a recognised Professional Institute will be considered an advantage. Salary £1,000/£1,120 per annum (N.J.C. Grade 9), Superannuable.

Apply within 7 days, stating age, experience, qualifications, salary and present position to Emil Braathen, Manager, Midlands Electricity Board, Birmingham and District Sub-Area, 14 Dale End, Birmingham 4.

A. STEPHENS,
Secretary.
(H 742)

KENT COUNTY COUNCIL

REQUIRE an ELECTRICAL ENGINEERING ASSISTANT with practical experience in installation work. Salary within the range £490 to £595 a year according to experience and qualifications. Further details and forms of application obtainable from the County Architect, Springfield, Maidstone.

(H 769)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

SHIFT CONTROL ENGINEER
Derby Power Station
Vacancy No. 75/54/ET

Applicants should have had a sound training and practical experience in a modern Generating Station. The possession of a Higher National Certificate in Electrical Engineering or its equivalent, would be advantageous.

The salary will be in accordance with Class F, Grade 10 (£577/£598 per annum) of the National Joint Board Schedule.

The closing date for receipt of applications will be 27 May, 1954.

SECTION LEADER
(Civil Engineering Design)
Construction Department
Vacancy No. 55/54/ET

Candidates should have experience in design and detail of heavy reinforced concrete structures, heavy foundations, retaining walls, bridges and the like.

Preference will be given to candidates who are Corporate Members of the Institute of Civil Engineers or equivalent qualifications.

The salary will be in accordance with Grade 3 (£780/£884 per annum) of Schedule D, of the National Joint Board Agreement.

The closing date for receipt of applications will be 27 May, 1954.

JUNIOR ENGINEER
Avon Power Station
Vacancy No. 77/54/ET

Applicants should be suitably qualified Engineers with some experience in Power Station operation.

Salary for this appointment is £445 per annum within Class E, Grade 14, of the National Joint Board Agreement.

Closing date for receipt of applications will be 9 June, 1954.

The above positions will be pensionable within the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box No. 25, British Electricity House, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
(H 783)

CHIEF ELECTRICAL ENGINEER AND MANAGER

required by the GOVERNMENT OF THE LEEWARD ISLANDS FOR SERVICE IN ST. KITTS NEVIS for four years with prospect of permanency. Salary £1,150 a year. Free passages. Liberal leave on full salary. Candidates, preferably Graduates of the Institution of Electrical Engineers, experienced in practical and administrative operation of electricity supply, ice-making and cold storage undertakings, should have knowledge of the operation and maintenance of 3·3 kV and 11 kW systems, and the erection of E.H.T. and L.T. overhead and underground A.C. transmission system network, and substation plant. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30566/EE. (H 752)

BRITISH ELECTRICITY AUTHORITY
South Western Division

ASSISTANT SHIFT CHARGE ENGINEER required at Plymouth "B" Generating Station.

Superannuation Scheme. Salary, N.J.B. Class "G," Grade 9, £641/£667.

Applicants should have good technical qualifications, and a knowledge of the operation and maintenance of generating plant.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 5 June, 1954. (H 757)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

DEMONSTRATOR required in the St. Helens District. Salary within the range £400/£490 p.a. (N.J.C. Grade I). Appointment superannuable and subject to medical examination.

Applicants should have had a good general education and be in possession of a recognised diploma in Domestic Science or other approved certificate. Previous experience in the Electricity Supply Industry advantageous. Candidates must be able to conduct demonstrations both in the Board's Service Centres and on consumers' premises, and to advise consumers on the selection and use of electrical apparatus. The successful applicant may also be required to give general assistance in a Service Centre.

Standard application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire. Closing date, 31 May, 1954. (H 744)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside and N. Wales Division

REQUIRES JUNIOR ENGINEERS on operating staff of power stations in North-West England, particularly in Manchester, Bolton, Wigan and Stalybridge areas. Applicants should have served an apprenticeship and have at least O.N.C. in electrical engineering, or equivalent engineering qualification which includes fundamental knowledge of electro-technology. Salaries vary between £402 and £545. Good prospects. Pension scheme.

Written applications quoting vacancy No. 75/54 to Divisional Controller, British Electricity House, 825 Wilmslow Rd, Manchester 20. (H 733)

KARACHI ELECTRIC SUPPLY CORPORATION

APPLICATIONS are invited for the following posts with The Karachi Electric Supply Corporation Ltd., Karachi, Pakistan, which owns two adjoining oil/gas-fired Steam Power Stations, one 25 (5 x 5) MW and one 30 (2 x 15) MW (under construction—400 psig/775° F. 11·4/66 kV block transformation), also Diesel Power Station (6 MW). Each appointment will be initially for 3 years. Monthly salaries will be paid in Pakistani Rupees per month in the scales stated below. A higher salary than the maximum may be granted in deserving cases (at present £1=Rs. 9/5/-). Employees engaged from overseas will also receive Overseas Allowance stated below. First-class passage forward at commencement and return on termination of agreement and also during leave after 3 years' service will be paid, also for wife and up to three children. Motor Car Allowance will be given to those owning cars. Applications stating age, qualifications, full particulars of experience, posts held and salary drawn during last seven years, and names of three independent referees, should be addressed to the Managing Director (Agents), Karachi Electric Supply Corporation Ltd., Electric House, Elphinstone St, Karachi, Pakistan. Each application will be acknowledged.

(*a*) DEPUTY MANAGER (Generation).—Salary Rs.2,250—100—3,050 per mensem. Overseas Allowance Rs.400 per mensem. Motor Car Allowance Rs.200 per mensem. To take administrative charge of all K.E.S.C. power-generation facilities. Applicant must have had good general and high technical education, preferably be a Corporate Member of a recognised Engineering Institution and have had at least 15/20 years' specialised experience in planning, installation, operation and maintenance of large Steam Power Stations, preferably with oil/gas-fired boilers. The applicant must also have had specialised administrative experience in this field.

(*b*) DEPUTY MANAGER (Transmission and Distribution).—Salary Rs.2,250—100—2,750 per mensem. Overseas Allowance Rs.400 per mensem. Motor Car Allowance Rs.200 per mensem. Applicant must have had good general and high technical

continued in next column

Continued from previous column

education, preferably be a Corporate Member of a recognised Electrical Engineering Institution, and have had at least 15/20 years' experience in planning, estimating, installation, operation and maintenance of 66-kV, 11-kV, 6·6-kV and low voltage cables, overhead lines and substations. The applicant must have also had administrative experience in this field.

(*c*) PROJECT ENGINEER (Transmission and Distribution).—Salary Rs.1,750—100—2,050 per mensem. Overseas Allowance Rs.300 per mensem. Motor Car Allowance Rs.175 per mensem. Applicant must have good general and technical education and be a Corporate member of a recognised Electrical Engineering Institution and have had at least 10 years' experience in the planning, estimating and erection of 66-kV, 11-kV, 6·6-kv and low voltage cables, overhead lines and substations.

(*d*) DEPUTY MANAGER (Commercial).—Salary Rs.2,250—100—2,750 per mensem. Overseas Allowance Rs.400 per mensem. To take full charge of Commercial Department. Applicant must have had education in Electrical Engineering to degree or diploma standard and must possess approved qualifications and experience of at least 15/20 years in the work connected with tariffs and power supply to industrial consumers.

(*e*) ASSISTANT MANAGER (Accounts).—Salary Rs. 1,750—100—2,050 per mensem. Overseas Allowance Rs.300 per mensem. Applicant must possess approved qualifications in commercial accountancy and must have had at least 10/15 years' experience in responsible posts in this field—preferably with power supply undertakings.

(*f*) ASSISTANT MANAGER (Commercial).—Salary Rs.1,750—100—2,050 per mensem. Overseas Allowance Rs. 300 per mensem. Applicant must have had at least 10/15 years' experience in responsible posts connected with tariffs and power supply to industrial consumers. (H 753)

CONSUMERS ENGINEER
(M2C/30379/EE)
ASSISTANT CONSUMERS ENGINEER
(M2C/30380/EE)

required by the GOVERNMENT OF ADEN ELECTRICITY DEPARTMENT for one tour of 18/24 months with prospect of permanency. Salary in scale £1,494 rising to £1,662, and £930 rising £1,452 a year respectively. Outfit allowance £60. Free passages. Furnished government quarters available at moderate rental. Liberal leave on full salary. Consumers Engineer: Candidates possessing H.N.C. or equivalent should have had considerable experience in the Consumers branch of a Public Electricity Undertaking and should be able to deal with the Administrative details and routine entailed. Experience in meter testing and organisation would be an advantage. Assistant Consumers Engineer: Candidates with O.N.C. or equivalent should have had experience in a similar post of a Public Supply Authority. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote the reference number against the post for which application is made. (H 750)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

JUNIOR ENGINEER is required at Nechells "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule "A" of the Agreement, Grades J18 to J14, commencing at £402 per annum.

A sound general education and technical training is required and preferably some power station experience. Appropriate technical qualifications an advantage.

Apply quoting Vacancy No. 664MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 3 June, 1954. (H 771)

LONDON ELECTRICITY BOARD

CHIEF ACCOUNTANT

APPLICATIONS for the position of Chief Accountant to the London Electricity Board are invited from fully-qualified accountants of proved financial and administrative ability and with experience in the service of public authorities, public utility undertakings or large commercial organisations.

The salary will be within the provisional range of £2,750 to £3,000 per annum but will be settled according to the age, experience and qualifications of the person appointed.

Applications stating age, qualifications, experience, present position and salary should be made by 10 June, 1954, to the Chairman of the Board at 46 New Broad St, E.C.2. (H 735)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER required in the Planning and Operation Section of No. 1 Sub-Area Headquarters, 24 Hatton Garden, Liverpool 3.

Salary £616 to £646 per annum, N.J.B. Class L, Grade 13. Applicants should preferably have the technical qualifications necessary to enable them to become Chartered Electrical Engineers. They should be experienced in all aspects of the distribution of electricity and possess knowledge of the technical and economic principles underlying the design of distribution systems.

The appointment is superannuable and subject to medical examination. Special application forms obtainable from the Manager above address.

Closing date, 31 May, 1954. (H 745)

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

THIRD ASSISTANT ENGINEER

(Civil)—Distribution Design Section

APPLICANTS should preferably be Corporate Members of the Institution of Civil Engineers or have equivalent qualifications, and must be fitted by training and experience to prepare civil engineering building designs, including reinforced concrete plant foundations; supervise the preparation of working drawings; prepare building specifications, Bills of Quantities, and check and report on building tenders. Specialised experience on the layout of distribution substations will be an advantage.

Salary—N.J.B. Class N, Grade 10, £846/£873 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 3 June, 1954.

No. 5 (Wakefield) Sub-Area

THIRD ASSISTANT ENGINEER

(Distribution Design)

Applicants must have had practical experience in the construction, maintenance and operation of E.H.V. and M.V. distribution systems. Preference will be given to those having planning and estimating experience of urban and rural distribution networks.

Salary—N.J.B. Class K, Grade 10, £719/£750 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 3 June, 1954.

No. 6 (Hull) Sub-Area

Hull District

GENERAL ASSISTANT DISTRICT ENGINEER

Applicants should have had a good general and technical education with practical training, preferably in the Electricity Supply Industry, and should be Graduate Members of the Institution of Electrical Engineers, or hold equivalent qualifications. They should have experience in the construction of overhead lines, and experience in operation and

continued in next column

continued from previous column

maintenance will be an advantage.

The successful applicant will be required to reside in Hull and may be required to undertake standby duties.

Salary—N.J.B. Class H, Grade 11, £607/£628 per annum.

Bridlington District
(Driffield)—Two Posts

THIRD ASSISTANT DISTRICT ENGINEERS

Applicants should have had a good general and technical education, with practical training, preferably in the Electricity Supply Industry, and should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications. They should have experience in the construction of overhead lines, and experience in operation and maintenance will be an advantage.

The successful applicants will be required to reside in Driffield and may be required to undertake standby duties.

Salary—N.J.B. Class D, Grade 9, £561/£578 per annum.

Bridlington and Goole Districts

GENERAL ASSISTANT DISTRICT ENGINEER

Applicants should hold the Higher National Certificate in Electrical Engineering or hold equivalent qualifications and have had experience in the construction, operation and maintenance of E.H.T. and L.T. overhead and underground distribution systems, in a mixed urban and rural district.

The successful applicants will be required to reside in Driffield or Goole and may be required to undertake standby duties.

Salary—N.J.B. Class D, Grade 11, £500/£516 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 3 June, 1954.

No. 7 (Grimsby) Sub-Area

Gainsborough District

SALES REPRESENTATIVE

Applicants will be required to give advice within well defined instructions and under close supervision to both urban and rural consumers in respect of new supplies and sales of domestic and agricultural equipment and to advise consumers on all types of domestic and agricultural installations and prepare estimates in this connection.

Salary—N.J.C. Grade 1, £400/£490 per annum.

Scunthorpe District

SALES REPRESENTATIVE

Applicants will be required to give advice within well defined instructions and under close supervision to both urban and rural consumers in respect of new supplies and sales of domestic and agricultural equipment and to advise consumers on all types of domestic and agricultural installations and prepare estimates in this connection.

Salary—N.J.C. Grade 1, £400/£490 per annum.

Gainsborough District

SENIOR SERVICE CENTRE ASSISTANT

Applicants should have had previous experience in Service Centre work including the sale of electrical appliances, Hire Purchase Agreements, handling of enquiries, etc., and must be capable of advising consumers on any matter relating to the use of electricity in their homes. A knowledge of window display will be an advantage.

Salary—N.J.C. Grade 2, £485/£545 per annum.

Scunthorpe District

SERVICE CENTRE ASSISTANT

Applicants who should possess a good general education and good appearance, will be required to undertake general showroom duties which will include the sale of electrical appliances, the handling of consumers' enquiries and general clerical work.

Salary—N.J.C. General Clerical Grade.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 3 June, 1954. (H 758)

BRITISH ELECTRICITY AUTHORITY
South Eastern Division

ASSISTANT SHIFT CHARGE ENGINEER—Croydon "B" Power Station. Applicants should preferably possess technical qualifications equivalent to Graduate membership of either the Institution of Mechanical or Electrical Engineers. Experience in the efficient operation of modern high pressure power station plant with P.F. firing and experience in the administration and control of labour essential. N.J.B. Conditions of Service and salary Class J, Grade 9, £754. 19s. per annum including London Allowance. Applications giving details of education, present position, experience, etc., should be received by the Station Superintendent, Croydon "B" Power Station, Beddington Farm Lane, Purley Way, Croydon, Surrey, by not later than 29 May, 1954. (H 741)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

THIRD ASSISTANT ENGINEER (Control) is required in the System Operation Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule "C," Grade 5, commencing in range £649 to £790, ultimately rising to £858.

Applicants should have had a sound technical training and practical experience in connection with system control. The possession of appropriate technical qualifications and experience within a power station will be considered advantages.

Apply quoting Vacancy No. 666MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 5 June, 1954. (H 772)

BRITISH ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 48/54

APPLICATIONS invited for superannuable N.J.B. appointment as DEPUTY STATION SUPERINTENDENT at Cardiff and Llynfi Power Stations. Salary, Grade F.3, £912/£951 and G.3, £971/£1,014 respectively.

Applicants should preferably be Corporate Members of the Institution of Mechanical and/or Electrical Engineers and have had considerable experience in the operation, maintenance and administration of a modern generating station including (for the Llynfi appointment) experience of pulverised fuel.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 31 May, 1954. (H 770)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside and N. Wales Division

GENERAL ASSISTANT ENGINEERS in Technical Department (Protection Section) at Preston (Vacancy No. 77/54) and Kearsley (No. 78/54). Applicants should possess H.N.C. (Elec.), be familiar with protective relays, protective schemes and have good knowledge of indoor and outdoor switchgear. Duties include assisting in testing, commissioning, routine maintenance and fault investigation of primary equipment and its associated protective gear and control and indicating circuits. Salary £501/£714 (AX/EX. 8).

Apply, quoting vacancy No. to Division Controller, British Electricity House, 825 Wilmslow Rd, Manchester 20, before 29 May. (H 743)

LONDON COUNTY COUNCIL

ELECTRICAL ENGINEERING ASSISTANTS (a) and (b), some with experience with lifts including examination of reports from outdoor staff, assessing necessary work, making surveys and recommendations for improvements. Applicants for (a) should hold H.N.C. (Elec.) or equivalent, for (b) O.N.C. (Elec.) or equivalent. Apply within 14 days on form for which send S.A.E. to Chief Engineer (54/21), County Hall, S.E.1. (568.) (H 736)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

STATION SHIFT CONTROL ENGINEER is required at Meaford "A" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule "A" of the Agreement, Grade G10, commencing at £608 per annum.

A sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Apply, quoting Vacancy No. 667 MD, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 5 June, 1954. (H 773)

(A) DIESEL ELECTRIC SUPERVISOR
(M2C/30564/EE)
(B) DIESEL MECHANICAL SUPERVISOR
(M2C/30565/EE)

required by the NIGERIA GOVERNMENT RAILWAY for one tour of 18 to 24 months in the first instance. Appointment either on contract terms with gratuity £100/£150 a year and salary, etc., in scale £1,170 rising to £1,453 a year; or with prospect of pensionable employment and salary, etc., in scale £1,085 rising to £1,315 a year. Outfit allowance £30/£60. Free passages for officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for their maintenance in U.K. Liberal leave on full salary. For (A) candidates, under 45 years of age, should have served an apprenticeship with a manufacturer of electric traction equipment or with an electric traction department of a railway, and have had at least seven years' subsequent workshop experience in the overhaul and operation of traction equipment. For (B) candidates, under 45 years of age, should have served an apprenticeship on the manufacture of heavy diesel engines and have had at least seven years' subsequent experience in the trade, including repairs work as well as new work. A knowledge of machine and fitting shop methods is necessary. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote the reference number against the appointment for which application is made. (H 793)

ASSISTANT ENGINEER
(Electrical and Mechanical)

required by the GOLD COAST GOVERNMENT RAILWAYS for the Takoradi Harbour Extensions for one tour of 12 to 18 months. Fixed consolidated salary £1,600 a year. Gratuity £150 a year. Outfit allowance £60. Free passages. Liberal leave on full salary. Candidates, not less that 30 years of age, should preferably be A.M.I.E.E. or hold an engineering degree. They should have had experience of installation of substations, power cables, dockside cranes, and internal electrical installation, and also have had drawing office experience. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30498/EE. (H 794)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following vacancies:

Fens Sub-Area Headquarters, Cambridge

59/54.R
2ND ASSISTANT ENGINEER (COMMERCIAL)

Candidates should have received sound technical and practical training in general electrical engineering work, particularly on the utilisation side.

Salary in accordance with Class H, Grade 6, of the National Joint Board Salary Agreement, commencing at £833.

Apply to the Manager, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge.

Chilterns Sub-Area Headquarters, Bedford

31/54.R
TWO ENGINEERING DRAUGHTSMEN

Candidates should have had a good general and technical education and preferably experience in the following:

(a) Design and construction of substation

continued in next column

continued from previous column

buildings and layout of equipment.
(b) Reinforced concrete and steel structures and general building construction.

Salary in accordance with Grade 6, Schedule D of the National Joint Board Salary Agreement within a range £433 to £567.

Apply to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford.

Northmet Sub-Area
Bishop's Stortford, District
57/54.N
SENIOR SALES REPRESENTATIVE

The duties will consist of giving advice on supply matters, tariffs, apparatus and sales to consumers with domestic or small commercial or industrial installations.

Salary in accordance with Grade 2 (£485 by £20—£545) of the National Joint Council Salary Agreement.

Apply to the District Manager, Bishop's Stortford, Eastern Electricity Board, Electricity Offices, 25 North Street, Bishop's Stortford, Herts.

Hendon District
60/54.R
GENERAL ASSISTANT ENGINEER

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. underground systems.

Salary in accordance with Class F, Grade 11, of the National Joint Board Salary Agreement commencing at £548.

Apply to the District Manager, Hendon, Eastern Electricity Board, 137/9 Brent St, Hendon, London, N.W.4.

Letchworth District
61/54.R
SENIOR SERVICE CENTRE ASSISTANT

Candidates should be capable of taking charge of a service centre, controlling service centre staff and handling consumers inquiries efficiently. They should have had extensive sales and consumer service experience and possess a thorough knowledge of appliances, contracting and the application of standard tariffs. The possession of the E.D.A. Salesmanship Diploma or E.A.W. Certificate will be an advantage.

Salary in accordance with Grade 2 (£485 by £20—£545) of the National Joint Council Salary Agreement.

Apply to the District Manager, Letchworth, Eastern Electricity Board, Works Rd, Letchworth, Herts.

Future salary and conditions of service for the above appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience with details of present appointment and salary, should be submitted to the Manager concerned within fourteen days of the appearance of this advertisement. (H 777)

BRITISH ELECTRICITY AUTHORITY
Yorkshire Division

APPLICATIONS are invited for the appointment of POWER STATION SUPERINTENDENT at Blackburn Meadows Power Station, Sheffield.

Salary £1,235/£1,289 per annum. Class H, Grade 1, National Joint Board Agreement.

Applicants should have had wide experience in the operation and maintenance of large modern power station plant and have held a position of responsibility involving the control of staff.

Preference will be given to engineers who are Corporate Members of the Institution of Electrical Engineers and/or Institution of Mechanical Engineers or who hold equivalent qualifications.

Applications on Forms A.E.6/ACT, obtainable from the Divisional Secretary (Establishments), British Electricity House, St. Mary's Rd, Leeds 7, to be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
(H 792)

ALKALINE BATTERIES LTD., of Redditch, are the largest makers in the Empire of Alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its Technical Sales and Development Sections for Graduate ELECTRICAL ENGINEERS, not over 30 years of age, or for men nearing the end of their Degree Course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed to Commercial Manager, Alkaline Batteries Ltd., Union St, Redditch. (H 721)

A. REYROLLE AND COMPANY have vacancies for CONTRACTS ENGINEERS in their Head Office at Hebburn, County Durham, for work on medium voltage switchgear contracts both for Home and Overseas work. Technical qualifications less than Higher National Certificate could be accepted and applicants should preferably be between 25 and 35 years of age.

The work is varied and interesting and may lead to other appointments on inside or outside contracts work. Applications should be forwarded to the Contracts Manager, A. Reyrolle and Co., Ltd., Hebburn, County Durham. (H 718)

BRITISH Engine Boiler and Electrical Insurance Company Ltd., 24 Fennel St, Manchester 4. The Company requires additional ELECTRICAL PLANT INSPECTORS in various districts in England and also in Edinburgh and Dublin. Permanent positions carrying progressive salary scale £540 to £785 and non-contributory pension. Candidates age 26 to 30 years, with apprenticeship in the manufacture or repair of electrical machinery and preferably with subsequent experience of industrial use of electrical machinery and who have gained the Higher National Certificate in Electrical Engineering or are Graduates of the Institution of Electrical Engineers are invited to apply in own handwriting stating age, qualifications and experience. (H 785)

C. AND J. CLARK LTD, STREET, requires an ELECTRICIAN with experience of high frequency dielectric heating. Applications to the Personnel Department marked "Private." (H 760)

CONTRACTS ENGINEER for London contractor specialising in excavating, cable laying and jointing. Duties to include estimating, preparation of technical specifications and supervision of contracts. Good technical background essential. Reply giving full particulars stating experience, salary required, and age.—Box No. 3543, Electrical Times. (H 763)

CONSULTING ENGINEERS require Senior and Junior Engineers for design of all types of electrical installations. Previous contracting or consulting experience desirable. Write giving full details of experience and salary required to—Box ET 223, LPE, 110 St. Martin's Lane, W.C.2. (H 737)

DRAUGHTSMAN of H.N.C. standard required, fully experienced in Power Transformers of highest voltages and capacities.
5-day week, pension scheme.
Apply to:
The Chief Mechanical Engineer,
The Hackbridge and Hewittic Electric Co., Ltd.
Walton-on-Thames, Surrey
Stating salary required and details of experience. (H 655)

DRAUGHTSMAN required, fully experienced in Power Transformers up to 66 kV and up to 2,000 kVA.
5-day week, pension scheme.
Apply to:
The Chief Mechanical Engineer,
The Hackbridge and Hewittic Electric Co., Ltd.
Walton-on-Thames, Surrey
Stating salary required and details of experience. (H 656)

ELECTRICAL DRAUGHTSMEN
The English Electric Company Limited

have vacancies at their Liverpool Works for ELECTRICAL AND MECHANICAL DRAUGHTSMEN for interesting work on a wide variety of new projects. The essential requirements are previous experience as a draughtsman on the design and detail of circuit diagrams or any kind of light electromechanical equipment, mechanisms, sheet steel cubicles, die-castings, or welded fabrications for batch production.

Pensionable and progressive positions are offered to men with initiative.

Travelling expenses for interview will be paid. Write giving full details of age, qualifications, and experience, to **Dept. C.P.S., 336/7 Strand, W.C.2,** quoting Ref. 1099A. (H 648p)

EWBANK AND PARTNERS LIMITED require for the Middle East a DEPUTY POWER STATION SUPERINTENDENT for a 30 MW capacity Power Station together with a Distillation Plant having a capacity of two million gallons per day. Applicants should have held a Deputy Station Superintendent's position for at least three years. Preference will be given to applicants under 40 years of age. Experience with oil and gas fired boilers, condensing and back pressure turbo-alternators and large triple effect evaporators will be an advantage. Applicants should also have a working knowledge of Power Station chemistry. Full details of qualifications, training and experience must accompany the application. The starting salary offered is from £1,300 to £1,500 per annum according to experience plus a living allowance. Free furnished bachelor quarters and medical attention are provided. The contract in the first place is for two years and may be extended. Married accommodation is difficult and applicants must be prepared to occupy bachelor accommodation for at least the first year of service. Applications to be addressed to the Secretary, Ewbank and Partners Limited, Engineering Consultants, 10/11 Grosvenor Place, London, S.W.1. (H 762)

ENGINEER. Courtaulds Ltd. require for for their factory at Carrickfergus, Northern Ireland, a Power Station Engineer to be directly responsible to the Resident Engineer for the generation of factory steam and power requirements. The plant consists of 650 p.s.i. water-tube boilers, back-pressure and extraction turbines, evaporators and ancillary equipment. Candidates should possess sound technical knowledge and practical operating experience of modern power plant, particularly of chain-grate stoker-fired boilers.

Candidates should write for a detailed form of application to the Director of Personnel, Courtaulds Ltd., 16 St. Martin's-le-Grand, London, E.C.1, quoting the reference number C53. (H 680)

ELECTRICAL ENGINEERS are required by the British Standards Institution for work in connection with the approval of all types of electrical equipment for export to Canada. Applicants should have served an apprenticeship: essential technical qualifications at least equivalent to graduate membership of I.E.E.

The positions are pensionable and the salary (not less than £650) will be in accordance with qualifications and experience. Apply Establishment Officer, British Standards Institution, 2 Park St, London, W.1. W.1. (H 784)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.2.

ELECTRICAL DRAUGHTSMEN for design of lighting, power and instrument installations for chemical and oil refinery plants. Applicants should be experienced in the preparation of bills of material from design drawings. Salaries above average, five-day week, generous staff pension scheme. Write stating age, experience, and qualifications to Head Wrightson Processes Ltd., 24 Baltic St, London, E.C.1. (H 625)

JOHNSON AND PHILLIPS LTD. require a SENIOR SWITCHGEAR DESIGNS DRAUGHTSMAN. Only men having actual design and workshop experience and accustomed to working on own initiative with the minimum of supervision should apply. Vacancy offers good opening to the right man.

Applications giving full particulars of training and experience together with salary required, to Employment Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, S.E.7. (H 627)

NETTLE ACCESSORIES Ltd., Harper Rd, Wythenshawe, Manchester, require TWO REPRESENTATIVES for North and South London areas. Must reside within 20 miles of London. Car essential. Staff Pension Scheme. Considerable scope. Apply in strict confidence, giving details of experience, salary required, etc., to the Sales Manager. (H 681)

REQUIRED TECHNICIAN to be responsible directly to managing director for development and control of existing electric motor manufacturing department producing a full range of A.C. and D.C. machines up to 10 H.P. Applicants must be capable of electrical design and have works management experience. Progressive position. Assistance with housing.—Box No. 3529, Electrical Times. (H 716)

SHIFT CHARGE ENGINEER required for service with the Sudan Light and Power Co., Ltd., in Khartoum-Anglo-Egyptian Sudan. Basic salary in the range of £E.900/£E.1,380 per annum. Candidates must have good general education and sound technical training with ability to control and instruct staff; and extensive experience in the operation of diesel generating sets up to 1,200 kW and E.H.T. switchgear and associated control equipment. Steam generating plant will be added in the near future and an extra qualification would be knowledge of and experience in the operation of steam turbo-alternator plant and oil fired boilers up to 400 lb per sq in. In addition to basic salary a cost of living allowance will be payable, and a kit allowance of £E.50 on appointment.

Appointment will be on contract up to 5 years, including a period of 12 months probation, with a bonus payable on completion of the contractual period.

Free living accommodation with basic furniture or an allowance in lieu thereof. After satisfactory completion of the probationary period liberal leave on full salary with free passages. There is at present no income tax in the Sudan.

Applications stating age, education, qualifications, experience (with particulars of posts held), present appointment and salary with names of two references should be submitted to the Secretary, The Power and Traction Finance Co., Limited, Queens House, Kingsway, London, W.C.2. (H 727)

STOREKEEPER required for Paddington area; experienced in Electric Space Heating equipment; Write full information to Box H.533, Willing's, 362 Grays Inn Rd, W.C.1. (H 748)

SANTON LIMITED invite applications from suitably qualified gentlemen to represent them in the South Eastern Electricity Board Area. Technical knowledge of electric Water Heating is desirable but secondary to sales ability. Remuneration by salary, participation in profit bonus sharing scheme, and expenses. A car is provided. Applications in writing to East Acton Arcade, Old Oak Common Lane, Acton, W.3. (H 738)

SALES ENGINEERS, D.C. and A.C. motors and control gear required London, Manchester, and Birmingham areas. Outside sales experience essential. Apply in writing only to Sales Director, Veritys Ltd., Brettenham House, Strand, London, W.C.2. (H 702)

THE ENGLISH ELECTRIC CO., LTD., have vacancies at their Liverpool works for TRANSFORMER SALES and CONTRACTS ENGINEERS. Candidates should have H.N.C. in Electrical Engineering, and preference will be given to those with experience of this type of work. Reply stating age, experience and qualifications, to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 898A. (H 728)

TECHNICAL SALES REP., with Industrial eng. exp. required for Midlands area, to deal with application of elec. instruments, relays and timing apparatus. Salary from £600 p.a. Contributory Pension Scheme. Applications in confidence, with details of education, training, exp., age and other qual. to Everett Edgcumbe and Co., Ltd., Colindale Works, Hendon, N.W.9. (H 693)

TRANSFORMERS Sales Engineers. Bruce Peebles and Co., Ltd., Edinburgh 5, have vacancies for experienced Senior Contract and Tender ENGINEERS in their Transformer Sales Department. If necessary, assistance will be given in housing. State experience, age and salary required to Sales Manager at the above address. (H 787)

TWO keen young men required, age 21/30, for QUALITY CONTROL of all stages of manufacture of paper insulated cables. Applicants should preferably have minimum qualifications of Ordinary National Certificate and, if possible, previous experience within the cable industry. Good salary and excellent prospects for suitable candidate. Apply to the Secretary, W. T. Glover and Co., Ltd., Trafford Park, Manchester 17. (H 761)

THE CEMENTATION CO., LTD. require the services of a first-class ELECTRICAL FOREMAN for two tours of fifteen months each in Iraq. Good technical knowledge to Ordinary National Certificate standard and preferably with recent practical experience on Public Works sites. Duties will include installation and maintenance of 600 kW capacity diesel generating station, distribution system, numerous motors up to 120 h.p., telephone system and usual ancillary apparatus. Salary range £110/£130 per month plus free accommodation, messing and leave pay. Apply in writing to 39 Victoria St, S.W.1, with full details education, training and experience. (H 746)

TECHNICIANS for commissioning and maintaining digital and analogue computing equipment in the Farnborough area, experience on large electronic installations, or a full service course on radar, e.g. R.N., R.A.F. essential. Apply Elliott Brothers (London) Limited, Borehamwood, Herts. (H 795)

WANTED. INSULATION ENGINEER with experience of electrical machines, etc., to work on varied development problems. Salary according to experience and qualifications. Apply Personnel Manager, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17. (H 788)

YOUNG DRAUGHTSMAN required for Lighting Section of Civil Engineer's Office. Should be capable of preparing schemes for interior and exterior lighting. Maximum salary range at 36 years is £607. 10s. per annum. Opportunities of promotion. Residential and other travelling facilities available. Applications with details of experience to Civil Engineer, British Railways (L.M.R.) Euston Grove, N.W.1. (H 789)

APPOINTMENTS WANTED

ELECTRICAL ENGINEER, Swiss, 30 years of age, desires position in Telephone or Radio Industry. Background includes wide experience in projection, manufacturing and sale of Telecommunication, Signalling and Radio Installations. Languages: German, French, good knowledge of English. Write to cipher P 50860 Z Publicitas Zurich, 1, Switzerland. (H 739)

FIRST Class electrician desires work. ex. Army instructor R.E.M.E. All branches ex maths., Refs.—Box No. 3547, Electrical Times. (H 797)

YOUNG MAN assist Sales Manager, requires similar position, buying or representing.—Box No. 3539, Electrical Times. (H 730)

WANTED

WANTED WASTE MERCURY 12s. 6d. lb or more delivered depending on quantity, also Electrical Contacts, magneto points, etc. Keenest prices for all non-ferrous and precious scrap metals in any form. Cash on collection by arrangement. Belgrave Buyers (E.T.), 5 Belgrave Gardens, London, N.W.8. MAI 7513. (H 791)

WANTED. ROTARY CONVERTERS, any size.—Universal, 221 City Rd, London, E.C.1. (H 14)

WANTED, D.C. and A.C. ball-bearing MOTORS, motor generator sets, dynamos and alternators.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London, N.1. (H 12)

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper Ltd., 176 Brady St, Bethnal Green, E.1. (H 10)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (H 20)

ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum cleaner and drill armatures replaced from stock 24-hour service. Every job guaranteed. All vacuum cleaner parts, hoses, etc., in stock for any make. Apex washer agitator shafts stocked.—Regam Electric Cleaner Service, 95 Park Lane, Leeds 1. (H 25)

CAPACITY AVAILABLE for sub-assembly of small electrical/electronic equipment, laboratory electrical apparatus, glass annealing and blowing. Sordoviso Switchgear Ltd., Duke St, Loughborough. (H 796)

FISHER FOUNDRIES LTD., Greet, Birmingham 11, for Machine Moulded Precision Castings in gun metal and soft grey iron. Tel.: Victoria 0197. (H 53)

WORK WANTED. Capacity available for all types of COIL WINDING.—Box No. 2425, Electrical Times. (H 23)

BUSINESSES FOR SALE

SMALL Electrical Contracting Business with Freehold Living Accommodation, S.E. Essex.—Box No. 3533, Electrical Times. (H 722)

FOR SALE

A HIGH VACUUM IMPREGNATION UNIT or single or batch coil impregnation service to R.I.C. Specification 214 or individual requirements. — Blickvac, 505 Lordship Lane, S.E.22. Tel: Forest Hill 7089. (H 24)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 5566-9. (H 16)

A.C. and D.C. MOTORS, all sizes, large stocks. Fully guaranteed.—Milo Engineering Works Ltd., Milo Rd, East Dulwich, S.E.22 (Forest Hill 2278-9). (H 11)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi. 5105, 67 Rothschild Rd, W.4. (H 15)

DON'T forget reconditioned METERS are supplied by The Electric Meter Company, Dept. ET46, Castle Circus House, Torquay. (H 633)

DON'T worry about your electricity bills. Fit 1s. slot electric meters for hotels, bed-sitters, etc. Prices from 50s.—Selectrics, Department E.T., Castle Circus House, Torquay. Tel. 7218. Trade inquiries invited. Trade discount. (H 26)

FLUORESCENT BALLASTS—wide range —20 W, 30 W, 40 W, 80 W. Normal and high power factor. Built for long and dependable life—Optimum Performance—Quiet operation. Fully impregnated—Progressive compounding—Heavy encased housing—Quick deliveries. Data on request. Micramatic Ltd., Bournemouth, Hants. (H 360)

GRUBB IMMERSION HEATERS by return of post to your address. Let us send you our latest list and trade terms of these quality products. John Owner and Co., Ltd., Springfield Rd, Birmingham 13. Tel. SPRingfield 2939. (H 765)

HOUSE-SERVICE METERS, a.c. or d.c., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (H 17)

METERS reconditioned, all types, AC/DC, quarterly credit, single- and three-phase 3/4 wire, 2½/100 amp. Prepayment, single, dual and triple coin, fixed or variable tariff 2½/50 amp. Delivery ex-stock, guaranteed, free catalogue lists 200 types. Trade discount 33⅓%. The Electric Meter Company, Dept. ET46, Castle Circus House, Torquay. Telephone 7963. (H 635)

MERCURY SWITCHES are made by Hall, Drysdale and Co., Ltd., of 58 Commerce Rd, Wood Green, London, N.22. Tel.: BOW. 7221. (H 18)

ONE brand new, and unused Westinghouse complete 35 kV, 15 mA PRECIPITATOR RECTIFIER EQUIPMENT, consisting of control unit, regulator and rectifier tank unit. Leeds Chemical Cleaning Works Ltd., Apperley Bridge, Nr. Bradford. Telephone: Rawdon 231. (H 747)

PORTABLE CUMMINS DIESEL ALTERNATOR SET, 31 kVA, 3-phase, 400/440 V, 50 c/s, has had little use since complete overhaul. Offers to J.K.O. Cutters Ltd., Hughenden Ave, High Wycombe, Bucks. (H 740)

PURLEY CHOKES AND BALLASTS. Our 80-W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818-9. (H 21)

TIME SWITCHES for sale. Reconditioned or new. 12 months' guarantee. Immediate delivery. List from: J. W. Hughes, 3 St. Thomas' St, London Bridge, S.E.1. (Tel.: HOP 2759.) (H 586)

1947 BEDFORD 12 VAN in excellent condition, choice of four, from £225; 1948 Bedford as above, £275; 1942 Ford 10 cwt Van. Nice order, good tyres, £140; 1947 Ford 10 cwt Van. Good throughout, choice of two, £180; 1948 Ford 10 cwt Van. Choice of two, £230; 1951 Ford 5 cwt Van. Taxed, £225. Luton Auto Sales, 645 Dunstable Rd, Phone: Luton 2747. (H 764)

FLAMEPROOF MOTORS, M.G. SETS, D.C. MOTORS, GEARED MOTORS, A.C. MOTORS, TRANSFORMERS, CONTROL GEAR. SPECIALS. FLANGE MOTORS

ELECTROPOWER COMPANY LIMITED

Kingsbury Works, Kingsbury Rd, London, N.W.9

Tel.: COLindale 4621/3.

Grams: Lectropowa, Hyde, London (HI9p)

HOUSE SERVICE METERS. The Electric Meter Company, Dept. ET46, Castle Circus House, Torquay. (H 634)

PATENTS

THE proprietor of British Patent No. 651295, entitled "ELECTROSTATIC A.C. GENERATOR" offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 14 E. Jackson Blvd, Chicago 4, Illinois, U.S.A. (H 684)

MISCELLANEOUS

CITY AND GUILDS (Electrical, etc.) on "No Pass—No Fee" terms. Over 95 per cent successes.—For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook FREE and post free.—B.I.E.T. (Dept. 39), 29 Wright's Lane, London, W.8. (H 22)

AGENCIES

BESCOL Electric Ltd., Birmingham 8, manufacturers of Domestic Electrical Appliances, require AGENTS for the South and South Eastern, Midlands, North and South Wales, and Yorkshire, excluding North Riding, areas of England. (H 786)

MANUFACTURER of Domestic Electric Appliances requires COMMISSION AGENTS in most parts of England and Northern Ireland. Live connections with wholesalers and Electricity Boards essential. —Box No. 3545, Electrical Times. (H 790)

علاج
الصدمة الكهربائية

TREATMENT FOR ELECTRIC SHOCK

To meet special demands a "Treatment for Apparent Death from Electric Shock" wallchart with instructions printed in both ENGLISH and ARABIC. Mounted on metal, size 17″×11″, varnished, corded and eyeletted.

Quotations for other languages on application

The ELECTRICAL TIMES Ltd.

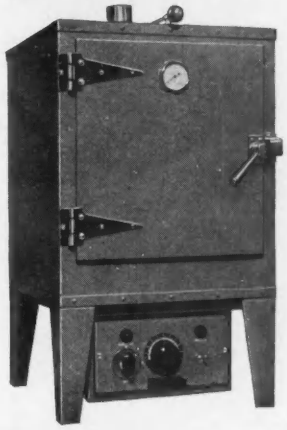
Sardinia House, Sardinia Street, London, W.C.2

UMENTS COUNTING INSTRUMENTS COUNTING INSTRUMENTS COUNTING INSTRUMENTS COUNTING
COUNTING INSTRUMENTS COUNTING INSTRUMEN COUNTING INSTRUMENTS COUNTING INSTRUMEN
NSTRUMENTS COUNTING INSTRUMENTS RUMENTS COUNTING INSTRUMENTS COUN
COUNTING INSTRUMENTS COUNTI INTING INSTRUMENTS COUNTING INSTR
ING INSTRUMENTS COUNTING INS ENTS COUNTING INSTRUMENTS
AENTS COUNTING INSTRUMEN NG INSTRUMENTS COUNTING
OUNTING INSTRUMENTS COUNTING INSTRUMENT
STRUMENTS COUNTI NSTRUMENTS COUN
COUNTING INS COUNTING INSTRU
NG INSTRUMEN UMENTS C
ENTS INTING I
UNTING UMENTS
TRUMENTS COUNTI
COUNTING INS OUNTING INSTRUM
G INSTRUMENTS CO G INSTRUMENTS CC
NTS COUNTING INSTRUM UMENTS COUNTING IN
NTING INSTRUMENTS COUNTING INSTRUMENTS
RUMENTS COUNTING INSTRUMEN OUNTING INSTRUMENTS COUNTIN
COUNTING INSTRUMENTS COUNTING G INSTRUMENTS COUNTING INSTRUME
INSTRUMENTS COUNTING INS
TS COUNTING INSTRUMENTS
TING INSTRUMENTS COUNTIN

Illustrated is our Medium Size Rotary Ratchet Drive Five Figure Counter with reset. Details of this and other models are given in our leaflet No. 1.

COUNTING INSTRUMENTS LTD.
5, ELSTREE WAY, BOREHAM WOOD, HERTFORDSHIRE
Telephone: ELSTREE 1382-3-4 *Cables:* COUNTHOR, BOREHAMWOOD

HEDIN



INDUSTRIAL HEATING APPLIANCES AND RESISTANCE UNITS

HEDIN, LTD.
COMMERCE ESTATE, SOUTH WOODFORD, LONDON, E.18
Tel.: BUC 6601/2

Electric Tachometers by SMITHS

Work conjointly with a generator for remote indication. Available with 4-in., 6-in., or 9-in. dials. Each instrument is individually manufactured and calibrated.

Other Smiths' Instruments include Magnetic and Hand Tachometers, 2-way Revolution Indicators, Cutting-speed Indicators, and Feet-per-minute Indicators.

Send for Leaflet Gt.23/1.

SMITHS

SMITHS INDUSTRIAL INSTRUMENTS LTD.
CHRONOS WORKS, NORTH CIRCULAR RD., LONDON, N.W.2
Northern Sales Office : York House, 12 York Street, Manchester
The Industrial Instrument Division of S. Smith & Sons (England) Ltd.

INDEX TO ADVERTISERS

Adcola Products Ltd. 2
Arora Co.... 16
Ash & Lacy Ltd. 64
Ashley Accessories Ltd.... 27

Belling & Co. Ltd. 4
Bray, Geo., & Co. Ltd. 28
British Electric Resistance Co. Ltd. ... 58
British Electricity Authority 53
British Insulated Callender's Cables Ltd. 25
British Thomson-Houston Co. Ltd. ... 6
Brush Electrical Engineering Co. Ltd.... 12
Burco Ltd. 67

Castle Engineering Co. (Nottingham) Ltd. 32
Clifford, Charles, Ltd. 52
Contactor Switchgear Ltd. 65
Cooper & Co. (B'ham) Ltd. ... *Cover* (ii)
Copper Development Association ... 11
Counting Instruments Ltd. 51
Crabtree, J. A., & Co. Ltd. 17
Cressall Manufacturing Co. Ltd. ... 8
Crompton Parkinson Ltd. 26

Danfoss Manufacturing Co. ... *Cover* (iv)
"Diamond H" Switches Ltd. 24
Downes & Davies Ltd. 36

East London Mica Works 20
Eeto Insulations 2
Electrical Times Ltd. 50
Electro Methods Ltd. 16
Electronic Laminations Ltd. 2
E.M.S. Electrical Products Ltd.... ... 66
Engel & Gibbs Ltd. 21
English Electric Co. Ltd. 31
Erskine, Heap & Co. Ltd. 22
Evershed & Vignoles Ltd. ... ...
(Industrial Maintenance, 52)

Ferranti Ltd. ... ... *Cover* (i)
Foster Transformers Ltd. 30

General Electric Co. Ltd. ... 23, 40
Gibson Todd & Co. Ltd. 3
Gillott Electro Appliances Ltd. ... 8
Gledhill-Brook Time Recorders Ltd.... 38
G.M. Engineering (Ottery St. Mary) Ltd. 63
(Industrial Maintenance, 56)
Grelco Ltd. 66
Gresham Transformers Ltd. 57

Hedin, Ltd. 51
Henley's, W. T., Telegraph Works Co. Ltd. 24, 41
Higgs Motors Ltd. 10
Hillman Electric Motors Ltd. 8
Holme, Edward, & Co. (1931) Ltd. ... 12

Isenthal & Co. Ltd. 28

Johnson & Phillips Ltd. 33

King, Geo. W., Ltd. ... ...
(Industrial Maintenance, 56)

Londex Ltd. 9
London Electric Firm Ltd. 28
Low, Duncan, Ltd. 38
Lyons, Claude, Ltd. 39

Martindale Electric Co. Ltd. 16
Mather & Platt Ltd. 54
Mek-Elek Engineering Ltd. ... ...
(Industrial Maintenance, 52)
Metallic Seamless Tube Co. Ltd. ... 34
Metropolitan-Vickers Electrical Co. Ltd. 15
Mitchell Engineering Ltd. 13
Morley's Electrical Services Ltd. ... 54

Nife Batteries 1

Oddie, Bradbury & Cull Ltd. 54

Parmiter Hope & Sugden Ltd. *Cover* (iii)
Parsons, C. A., & Co., Ltd. 37
Partridge, Wilson & Co., Ltd. 5
Power Petroleum Co. Ltd. 18
Premier Electric Heaters Ltd. 35
Process Control Gear Ltd. 38
Pyrene Co. Ltd. 64
Pyrotenax Ltd. 61

Resistances Ltd. 60
Reyrolle, A., & Co., Ltd. 55
Rowlands Electrical Accessories Ltd.... 56

Santon Ltd. 34
Sax, Julius, & Co. Ltd. 56
Service Electric Co. Ltd. ... ...
(Industrial Maintenance, 52)
Simmonds & Stokes (Niphan) Ltd. ... 56
Smart & Brown (Engineers) Ltd. ... 32
Smiths Industrial Instruments Ltd. ... 51
Solenoids & Regulators Ltd. 64
Spencer Wire Co. Ltd. 20
Sterling Varnish Co. Ltd. 7
Symons, H. D., & Co. Ltd. 62

Telegraph Construction & Maintenance Co. Ltd. 29
Thew, Edward H., Ltd. 66
T.M.C.-Harwell (Sales) Ltd. 14
Tok Electrical & Industrial Mechanisms Ltd. 35
Tucker, Geo., Eyelet Co. Ltd. 58
Tudor Accumulator Co. Ltd. 68
Turners Asbestos Cement Co. Ltd. ... 59

V.G. Porcelain Co., Ltd. 60
Volex Electrical Products Ltd. 19

Wandleside Cable Works Ltd.... ... 42
Washers Ltd. 66
Wilkinsons Tools Ltd. 62
Wootton & Co. Ltd. 60

PHOSPHOR BRONZE
FOR THE ELECTRICAL INDUSTRY

Sheet, Strip, Rod, Wire, Tube, Chill Cast Bars. In a range of alloys containing 3%—12% Tin for specific purposes; to private specifications and to British Standard Specifications.

CHARLES CLIFFORD LIMITED

DOG POOL MILLS, BIRMINGHAM 30 and FAZELEY STREET MILLS, BIRMINGHAM 5. *Offices: London, Glasgow, Manchester & Dublin*

M-W.104

THE FARMER

and the Balance of Power

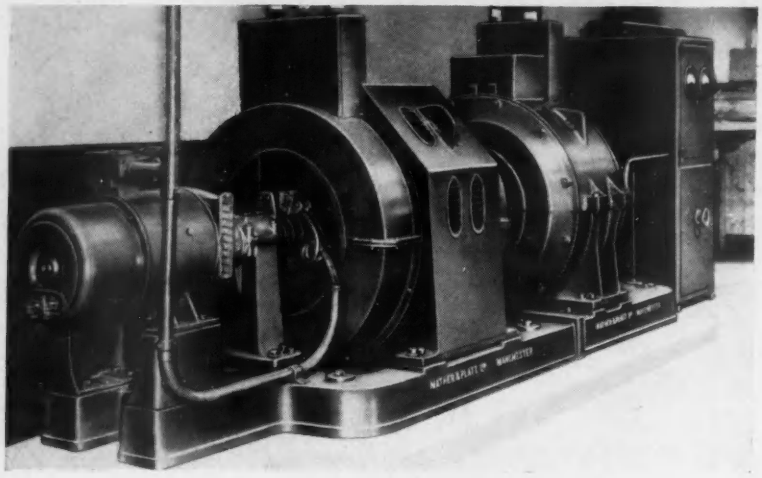
BRITAIN today has more electricity than she has ever had before. In the past six years, 40 new power stations have been brought into operation and power supply has increased by 50 per cent. At the same time, the demand for electricity is greater than it has ever been.

Electricity on the farms means more production from our existing resources and labour, and less reliance on imported food. Electricity on the farms means more home comforts for those who work on the land. Electricity on the farms contributes to a balanced load on the power stations.

If electricity were more widely used by farms, factories, shops, homes, offices and for street lighting—this would keep the generating plant more fully loaded. The demands on the power stations coming from these different classes of consumers would be diversified. That is to say the loads would not occur simultaneously but, in the main, at different times of the day—and continuous full output from the generating plant would reduce the cost of electricity.

BRITISH ELECTRICITY

ELECTRICITY PROSPERITY



POWER for Industry

MOTOR GENERATOR SETS

The motor generator set illustrated is installed at a South of England paper mill. The motor is a direct-on started 435 h.p. synchronous machine, 400 v., 0·5 leading power factor, 1,000 r.p.m., starting current 2½ times full load current. The D.C. generator supplies 300 kW, at 230 v.

MATHER & PLATT LTD PARK WORKS · MANCHESTER 10

437

ODDIE FASTENERS

PAT. No. 507249

The FASTENER with ENDLESS APPLICATIONS
SIMPLE — POSITIVE — SELF LOCKING

Made in a variety of types and sizes

SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS

Widely used in the Electrical Industry

DEPT.: E.T.

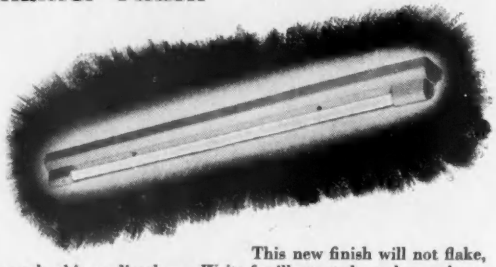
ODDIE, BRADBURY & CULL LTD.

SOUTHAMPTON

Tel.: 55883 **Cables: Fasteners, Southampton**

The MORLITE 4-STAR

Fluorescent Lighting Fittings with the NEW 'SUPER-HARD' Enamel Finish



This new finish will not flake, crack, chip or discolour. Write for illustrated catalogue showing full range of standard fittings.

★ **POSITIVE STARTING** (Quick Start or Switch Start).
★ **NOISELESS IN USE** (No Noise Level).
★ **QUICK DELIVERY** . . . and, of course, our
★ **TWO YEARS' GUARANTEE.**

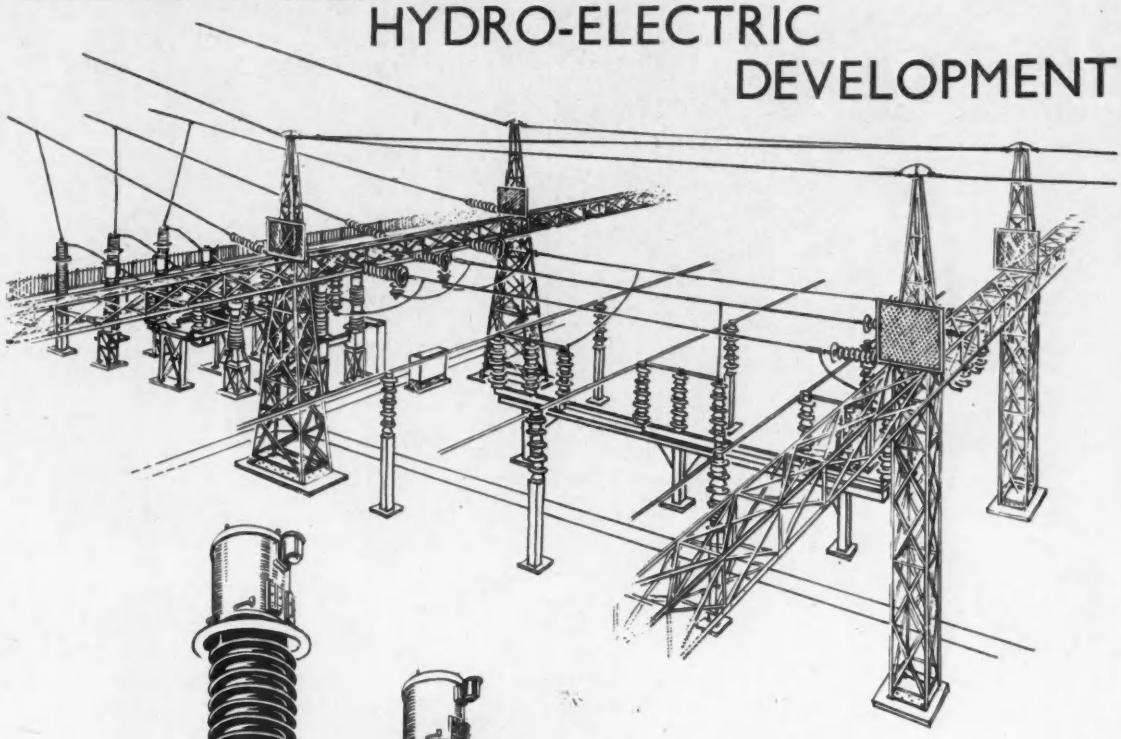
Fluorescent MORLITE lighting

MORLEY'S ELECTRICAL SERVICES LTD.

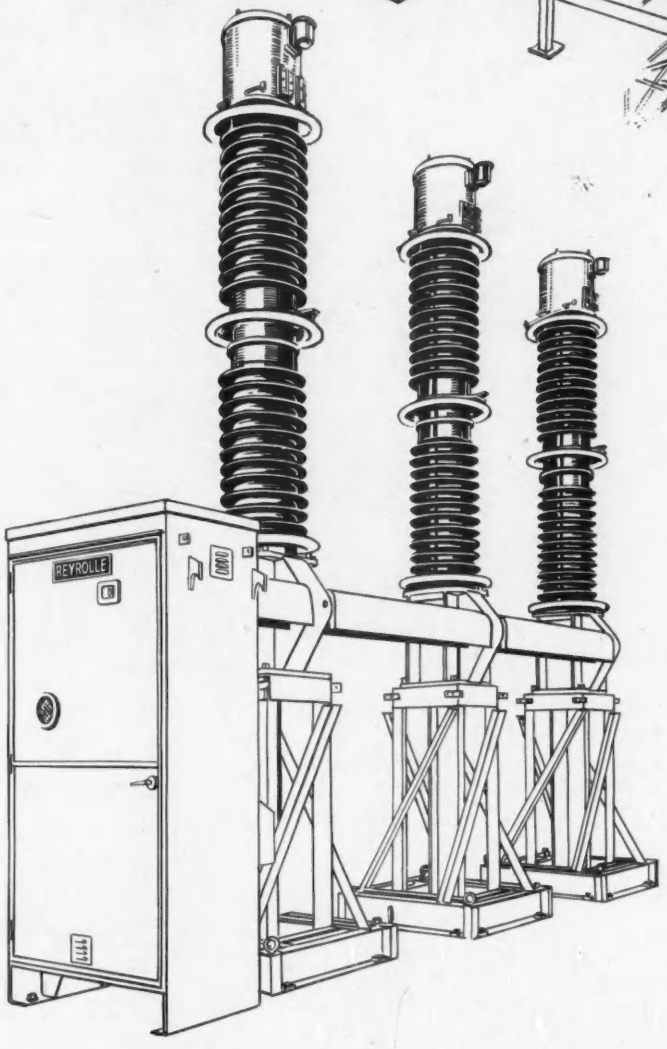
MODEL S.B.5. (illustrated)
£2.19.6 nett
COMPLETE with all Control Gear (less tube).

117, Hornsey Road, London, N.7
NORth 5008.

OWEN FALLS HYDRO-ELECTRIC DEVELOPMENT



Owen Falls 132-kV Switchyard



132-kV 2500 MVA
small-oil-volume
switchgear, having a
730-kV impulse-voltage
withstand, was
selected for OWEN FALLS,
KAMPALA NORTH, and TORORO
switching-stations
on the equator
to meet conditions of
high altitude (4000') and
frequent lightning storms

Reyrolle

A. REYROLLE & COMPANY LIMITED · HEBBURN · CO. DURHAM

PATENT No. 568702

WHAT IS THE R.E.A.L. LIFE OF A WATERTIGHT FITTING

Rain can't find a way in . . . and there's nothing whatever to corrode, so the R.E.A.L. Fitting —of all-porcelain one-piece construction — just CAN'T wear out. And, when a lamp goes, it's but a moment's job to unscrew the well glass and fit a replacement!

Leaflet No. P.9512 gives details of the 60 watt, 100 watt and 200 watt Fittings.

Issued by Rowlands Electrical Accessories Ltd., R.E.A.L. Works, Birmingham, 18

SAX

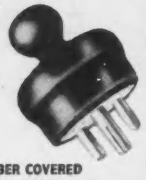
ELECTRICAL PRODUCTS

SPRING HINGED SOCKETS AND PLUG TOPS

METAL FLANGED FLUSH SOCKETS

Other Products include

- Ironclad Bells
- Luminous Indicators
- Transformers
- Bell Pushes
- Fire Alarm Systems



RUBBER COVERED PLUG TOPS

Standard Metal Flange Finishes

Polished Brass
Coinage Bronze
Chromium Plated

SHUTTERED SOCKETS & PLUG TOPS - ROTARY ACTION

TRADE MARK

JULIUS SAX & CO. LTD.
24 COMMERCE RD. BRENTFORD.
Telephone EALING 6034-5

NIPHAN CABLE COUPLINGS

Specialists in the design and manufacture of

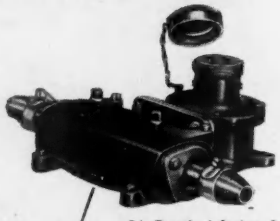
WEATHERPROOF METAL-CLAD

SOCKETS & PLUGS

5-300 amp. 250 to 500 volt. 3- & 4-pole earthed type, 2-pole, multi-pole, Single pole up to 600 amp. Designs to requirements.

For Electric Lighting Installations and Power Transmission, Communication, Portable Tools, etc:

C.I. Terminal Socket & Cover with terminal type sealing chamber and gland for cable.



C.I. Terminal Socket & Cover with through sealing chamber and glands for cable.

NIPHAN

Write for fully illustrated catalogue to:

SIMMONDS & STOKES (NIPHAN) LTD

VICTORIA HOUSE, SOUTHAMPTON ROW, LONDON, W.C.1

'Phone: HOLborn 2163, 8637. 'Grams: Niphan, Westcent, London

From DESIGN to DELIVERY

To Every Transformer Problem There is a GRESHAM Answer

Specialist Design Staff and Specialist Delivery Vehicles are typical of the care and knowledge which are involved in the making of every Gresham Transformer. From the moment the order is received each stage in production is supervised and checked so that nothing is left to chance.

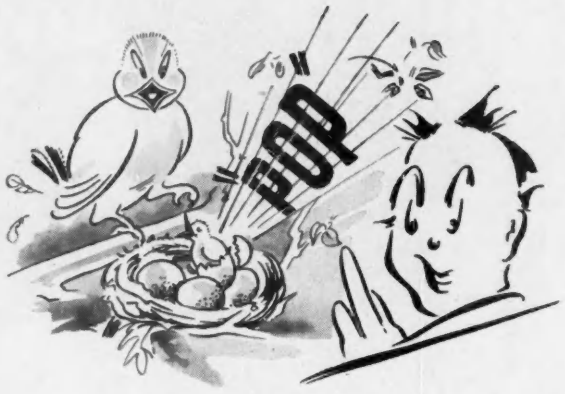
Our representatives are specialists too, and if you telephone FELtham 2271 your enquiry will be handled by engineers with experience of your type of problem.

HANWORTH **GRESHAM** MIDDLESEX
TRANSFORMERS LTD

TWICKENHAM ROAD, HANWORTH, MIDDLESEX. **FELtham 2271-4**

AH! THAT REMINDS ME

It's spring again and all manner of things are popping—eggs are popping, buds are popping and the sun is popping out more often. Popping that goes on all the year round, however, comes from "Pop" riveting. This modern method enables rivets to be fixed from one side only and in the most inaccessible places.
See our technicians if you have a riveting problem.



"POP" is a Registered Trade Mark of the manufacturers

Geo. TUCKER EYELET Co. Ltd.

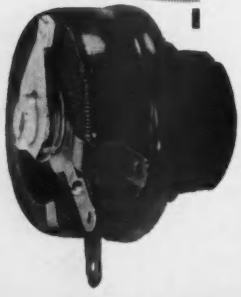
Walsall Road - - - BIRMINGHAM 22

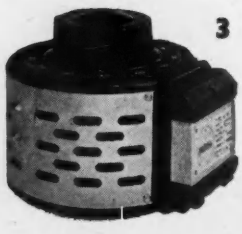
Consultants and Tool Manufacturers:

AIRCRAFT MATERIALS LTD., *MIDLAND ROAD, LONDON, N.W.1*

THE MODERN SYSTEM OF RIVETING

3 New Components FOR THE ELECTRONICS INDUSTRY





1 Bercostats. A new range of power rheostats for industrial electronics. 5 sizes from 25 to 150 watts. All ceramic construction. Windings embedded in vitreous enamel giving great mechanical strength. Finishes comply with RCS.1000. Available in open, protected and ganged models.

2 A range of 3 moulded knobs with collet fitting (Patent applied for) ensuring positive grip of circular shafts. Quickly and easily fixed and removed. Interchangeable collets for ¼", ⅜" and ⅜" shafts.

3 Berco Rotary Regavolt Variable Transformers. Two additions to the range of well known "Regavolt" regulating transformers, but of rotary type, for 200/250 volt supplies, ratings 0·8 and 2 amps respectively. Compact, smaller than any other transformer of comparable rating. Suitable for panel mounting.

* *See these and our wide range of high quality electronic components including: Hermetically sealed potentiometer, fully Type Approved to Class H.I. of RCS. 121. Vitreous enamelled resistors, also Type Approved to Class H.I. of RCS.111.*

THE BRITISH ELECTRIC RESISTANCE COMPANY LIMITED

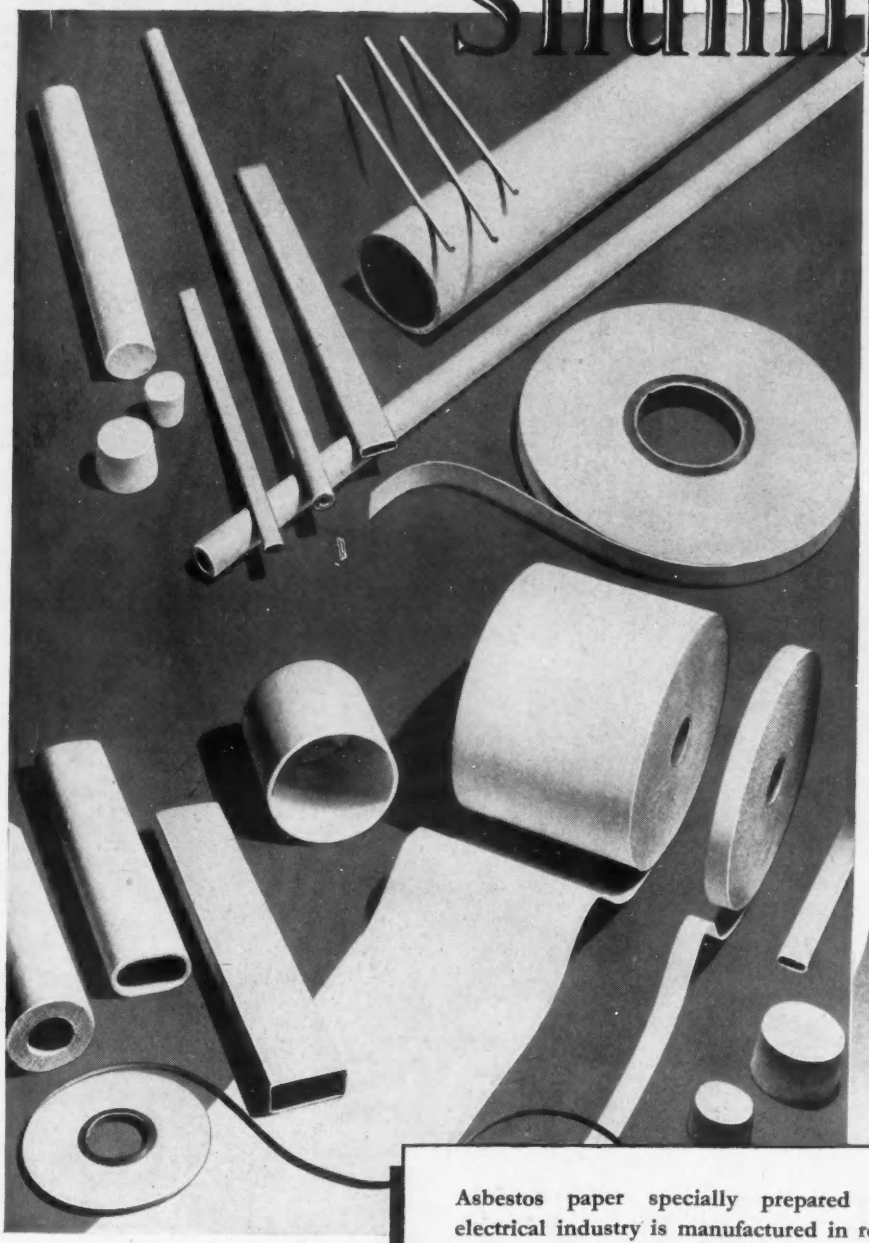
QUEENSWAY, PONDERS END, MIDDLESEX. TEL: HOWARD 1492 'GRAMS: "VITROHM, ENFIELD"

BERCO

BR 1091—AH

"Siluminite"

REGD. TRADE MARK



ASBESTOS PAPER, PAPER TAPE and PAPER TUBES

Asbestos paper specially prepared for use in the electrical industry is manufactured in roll form in widths varying from narrow tape up to 40 in. wide and in thicknesses ·005 in. to ·025 in. Asbestos paper tubes also for electrical application such as rewirable fuses are made in various sizes and grades to customers' requirements. Resinated asbestos paper ("Siluminite" ELS) is available in sheet or roll form 40 in. wide or as laminated boards 40 in. square in thicknesses up to 3 in.

TURNERS ASBESTOS CEMENT CO LTD

A MEMBER OF THE TURNER & NEWALL ORGANISATION

TRAFFORD PARK MANCHESTER 17

WOOTTON
METER BOARDS
AND SWITCH BLOCKS

We have been making and supplying the Electrical Industry with METER BOARDS and Switch Blocks for over 27 years.

- FIRST CLASS WORK
- QUICK DELIVERY
- COMPETITIVE PRICES

We invite your enquiries

WOOTTON & CO., LTD.

ALMA WORKS, PONDERS END MIDDX.

TELEPHONE : HOWARD 1858

AT YOUR SERVICE...

WITH

VARIABLE

RESISTANCES

OF EVERY KIND

- Size R.T. 25 Type BOB of 25 wts rating
- Size R.T. 50 Type BOB of 50 wts rating
- Size R.T. 150 Type BOB of 150 wts rating

Write or phone

RESISTANCES Ltd

30 OXFORD ROAD, LONDON, N.4. ARC 2155

For Every Gauge

IN EVERY WIRING INSTALLATION

BETTER, EASIER, SAFER, MORE PERMANENT THAN ANY OTHER CONNECTOR, FOR EVERY WIRING JOB AND FOR EVERY GAUGE WIRING.

SCRUIT

REGISTERED TRADE MARK

BRITISH MADE ONE PIECE PORCELAIN CONNECTORS

MADE BY V.G. PORCELAIN CO. LTD.

GORST RD., PARK ROYAL, LONDON, N.W.10. *Telephone* ELGAR 7362

Distributors : S. O. Bowker Ltd., GEE (Birmingham) Ltd., Birmingham and Metway Ltd., Brighton

this chemical age finds the answer..

The fumes of some chemicals are far more potent in their destructive effect than the weather at its very worst. So far as electrical wiring is concerned "Pyrotenax" is the final and proven answer.

"Pyrotenax" consists of solid copper cores firmly embedded in pure mineral insulant, all enclosed in a seamless copper sheath. In brief, it is wholly inorganic, and therefore virtually invulnerable to the processes of decay. Copper is the least affected by general corrosion of the metals in common use and in the vast majority of applications no additional protection of Pyrotenax cables is required. In those cases where even copper requires extra protection the seamless copper sheath of "Pyrotenax" still provides the efficiently bonded metal covering essential to electrical wiring in the chemical industry. This is why Monsanto Chemicals Limited, use "Pyrotenax" for feeder and control wiring at their Newport Works.

A non-technical description of "Pyrotenax" is given in our booklet "Current Carrying". For the technical man "Technical Data" is available —write for your copy.

The use of the trade name "Pyrotenax" is exclusive to the products of this company and its associates.

current events...

Pyrotenax

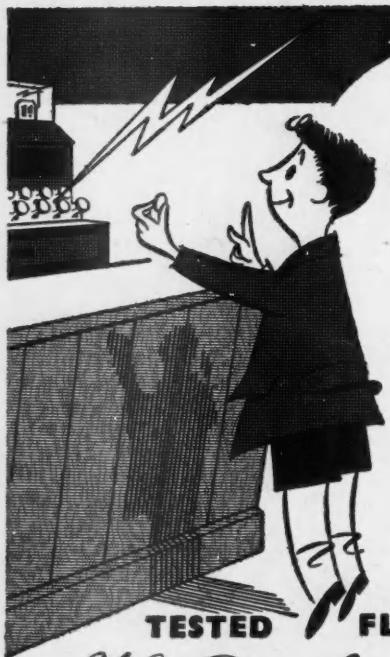
COPPER COVERED MI CABLES

PYROTENAX LIMITED
HEBBURN-ON-TYNE
Phone: HEBBURN 32244/7

LONDON	BIRMINGHAM	GLASGOW	MANCHESTER	LEEDS
Phone: Abbey 1654/5	Phone: Midland 1265	Phone: Central 2238	Phone: Blackfriars 6946	Phone: Leeds 27826

GD2

CW/2415/139



A pennyworth of megohms, please!

This infant prodigy, youngest son of our sales manager, shows forethought beyond his years. Yet Daddy should tell him there's more than a pennyworth of megohms in "Symite" high tension tubing. For instance, under normal conditions the insulation resistance measured with surface /1" length, in parallel with volume /1" length, is 10^6 megohms, at 100°C it's 10^4 megohms. High electric strength under all conditions of temperature and humidity is a characteristic of "Symite".

SYMITE

Standard, super tropical and high temperature, outstanding resistance to abrasion, will not crack or tear, the first and only high tension tube of its kind.

SYMEL

Extruded silicone elastomer sleeving, for operating temperatures up to 180°C; a high tension sleeving manufactured with a ¼ m.m. bore and 1 m.m. wall in addition to standard sizes.

Symons ADVISORY SERVICE

If you have an electrical insulation problem, send it to us! Our experts will be pleased to advise you.

TESTED FLEXIBLE INSULATION BY

H. D. Symons & Co. Ltd.

PARK WORKS · KINGSTON HILL · SURREY

TEL: KINGSTON 0091 · TELEGRAMS: INSULATION KINGSTON ON THAMES

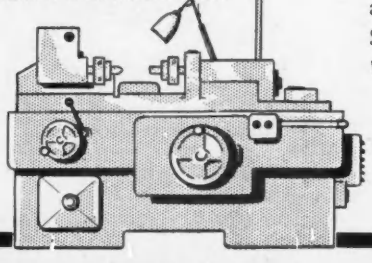
a move ahead

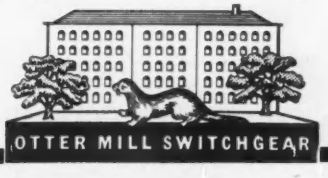
The Busbar Trunking system of electric power distribution allows you to go ahead with moving existing machines or installing new ones, with the minimum loss of production hours and without making temporary or makeshift connections. This totally enclosed, steel clad, fire resisting system consists of bare copper conductors, or Busbars, housed in a light but rigid steel duct which has tapping points at intervals of 2 feet. The ideal system is reasonable in first cost, cheap to install and capable of alteration or extension with all speed and with the least possible interruption to the electric supply. Standard Ratings:—175, 250, 300, 400, 500 and 600 amps.

Write for illustrated catalogue.

BUSBAR TRUNKING

the modern system of electric power distribution





G M ENGINEERING (OTTERY ST MARY) LTD

Sales Office: 1 VICTORIA ST LONDON SW1 Telephone: ABBey 5095 Telegrams: BUSBAR SOWEST LONDON

how safe is your plant from fire ?

Fire outbreaks cannot always be prevented. Damage can. The degree of safety you enjoy is in direct proportion to the extent and nature of your fire protection. Consult The Pyrene Company. It costs you nothing to have the impartial advice of Pyrene Fire Engineers. It may result in the saving of thousands of pounds worth of plant and equipment.

The wide experience of The Pyrene Company in developing CO_2, Dry Chemical, Special Liquids including Chlorobromomethane, Foam and all forms of fire fighting appliances and installations to meet the special needs of Electrical Industries, is at your disposal. In order to secure literature describing the full range of Pyrene Fire Fighting Equipment, or a visit from our technical representative — without obligation — write now to Dept. E.T.5.

THE PYRENE COMPANY LTD.
9 GROSVENOR GARDENS, LONDON, S.W.1

Pyrene TRADE MARK
FIRE FIGHTING EQUIPMENT

THE BEST KNOWN NAME IN FIRE PROTECTION

Perforated METALS

Round, square, club, diamond, rectangular or round ended slot holes available in a wide range of sizes and varying pitch.

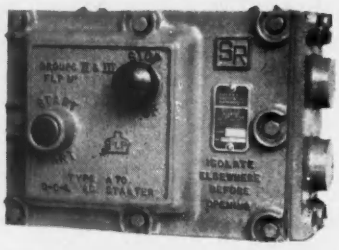
In Steel, Zinc, Copper, Brass, Aluminium, Monel or Stainless Steel. For ventilating, panelling, cable trays, filters, meat safes, machine guards, acoustic work, etc.

ASH & LACY LTD.
MERIDEN ST., BIRMINGHAM 5
Tel: MIDland 6871

7474

FLAMEPROOF
Buxton Certified
CONTROL GEAR

FLP



New list now available

- Starters for A.C. and D.C. Motors
- Push Button Stations.
- Shunt Regulators, Resistances, etc.
- Limit Switches

SR
SOLENOIDS & REGULATORS LTD.
268-270 MOSELEY RD., BIRMINGHAM, 12
Tele: CALthorpe 0532 Grams: Solenoid, Birmingham

CONTACTOR SWITCHGEAR LTD
WOLVERHAMPTON
ENGLAND

Multi Tier Motor Control Boards

The latest development by CONTACTOR SWITCHGEAR LIMITED in the field of multi motor control boards is shown by this illustration of a 25 motor panel, with individual isolation of each motor and a main switch fuse to control the incoming supply.

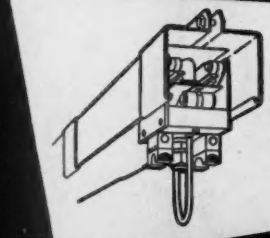
This method of construction is extremely flexible and enables the very minimum of floor space to be taken up and a first class appearance is preserved even when starters of widely varying size and type are incorporated.

May we send you further particulars?

CONTACTOR SWITCHGEAR LTD

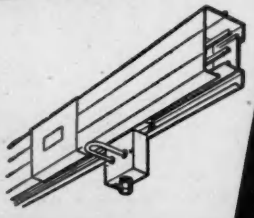
BLAKENHALL WOLVERHAMPTON ENGLAND

Telephone: Wolverhampton 25111 (5 lines) *Telegrams:* TACTORGEAR Wolverhampton

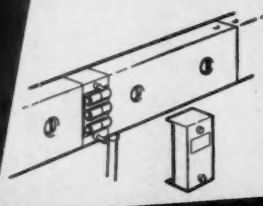


TROLLEY DUCT FEED RAIL
Consisting of one or more trolley collectors running on continuous conductor rails, the E.M.S. Trolley Duct avoids long, trailing leads on portable Tool installations, conveyor systems, movable pendant lights, etc.

"UNIDUCT" FEED RAIL
Designed for 400 volt 3 phase supply, with a maximum loading of 100 amps per phase, the "Uniduct" is particularly suitable for high frequency tool installations on conveyor systems, small mobile cranes and hoists where bare conductors and trailing leads are dangerous.

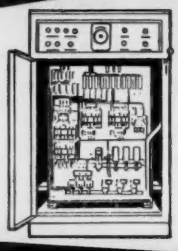


for industrial power users



"MINIBUS" DISTRIBUTION SYSTEM
A miniature Busbar distribution system designed for small industrial installations where total loading does not exceed 100 amps per bar, and the load of each machine does not exceed 30 amps, available for 2 phase, 3 and 4 wire supplied.

CONTROL PANELS
This automatic control panel built for Imperial Chemical Industries illustrates the type of work we can undertake. Panels can be supplied complete or in skeleton forms for building-in.



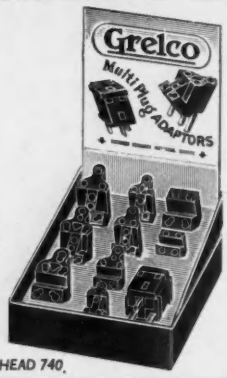
E.M.S ELECTRICAL PRODUCTS LTD

28, 32 THE BUTTS COVENTRY Tel. Coventry 61091 Grams. Dispatch Coventry

---

Grelco LIMITED

MULTI-PLUG ADAPTORS



MINEHEAD, SOMERSET Telephone MINEHEAD 740.

WASHERS LTD.

93 IRVING ST. BIRMINGHAM 15
MIDLAND 1423

ENGRAVED PLATES
OF ALL TYPES & IN ALL LANGUAGES

ENAMELLED - ENGRAVED - PLASTICS
CAST - DIECAST - BRONZE

EDWARD H. THEW LTD.

3 First Avenue, Team Valley, Gateshead-on-Tyne, 11
TELEphone: Lowfell 75667
grams: "Engraving, Gateshead-on-Tyne"

the biggest attraction in your window

Burco

. . . the finest recommendation for your shop

MODEL E840
IN CREAM OR WHITE
NO PURCHASE TAX

The word soon goes around when you display a BURCO Electric Wash Boiler, for it carries a reputation for enviable efficiency. It's the model every housewife WANTS—show her how easy it is to get ! Every time you sell a BURCO you cement your reputation.

Supported by bigger advertising than ever

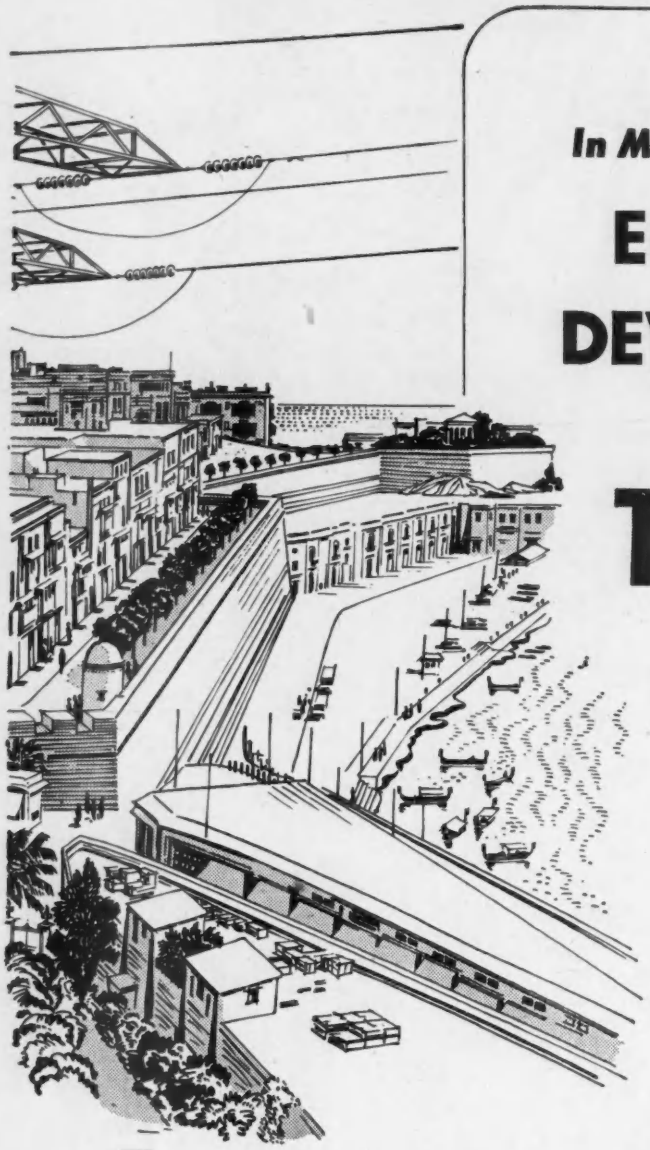
The Aristocrats of Electric Washday Appliances

Burco

BURCO LTD.

ROSE GROVE, BURNLEY, LANCS.

Also makers of the famous Burco All-Electric Washing Machine



In Malta as in Great Britain

ELECTRICAL DEVELOPMENT depends on TUDOR

Tudor are supplying fifty 30-volt self-contained switch tripping equipments to J. G. Statter & Co. Ltd. to whom the Crown Agents, on behalf of the Malta Government, have awarded the contract for supply of the 11 kV switchgear required for reconstructing the distribution system. The Consulting Engineers are Messrs. Preece, Cardew & Rider. The reconstruction involves changing from single phase, 100 cycles to 3-phase, 50 cycles which will enable the l.v. system to be standardised at 415/240 volts, 50 cycles.

FOR OVER FIFTY YEARS The Tudor Accumulator Company has specialised in the design and manufacture of batteries for switchgear operation, indication and emergency duties in power stations and substations; and Tudor Batteries have played a large part in the recent expansion of electricity supply in Britain. Wherever they are in service, Tudor Batteries are noted for their outstanding reliability and low maintenance cost under all conditions.

Tudor engineers will be pleased to prepare a specification of the most economical battery scheme to meet your requirements.

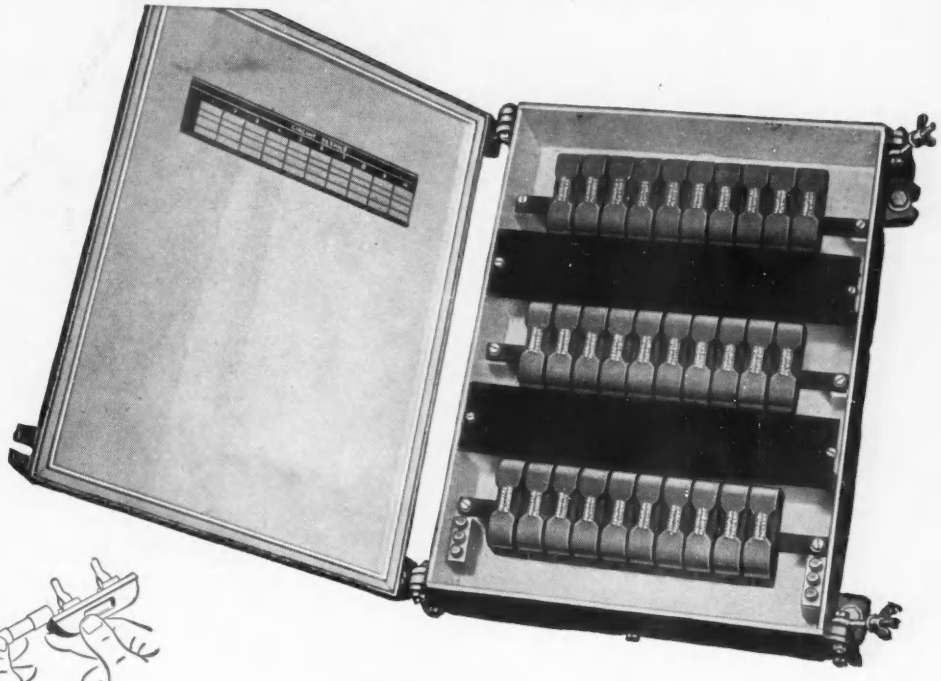
Tudor BATTERIES

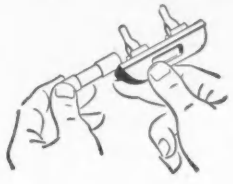
T.131

THE TUDOR ACCUMULATOR COMPANY LIMITED · 137 VICTORIA STREET · LONDON · SWI

Printed in England by Staples Printers Limited at their Great Titchfield Street, London, establishment, for the Proprietors, THE ELECTRICAL TIMES LTD., and published at Sardinia House, Sardinia Street, London, W.C.2.

For ELECTRICAL PROTECTION





Type VB 15 AMP and Type VM 30 AMP for circuits up to 500 volts with Breaking Capacity 25,000 KVA to 440 AC4. Wiring is made simple by the removable end plates which facilitate drilling and the Aeroflex high breaking capacity rewirable cartridge fuses are carried in self-securing contacts. The busbars are secured to fuse contacts at ends resulting in clear wall space behind.

AEROFLEX Fluvent HOPE'S PATENTS

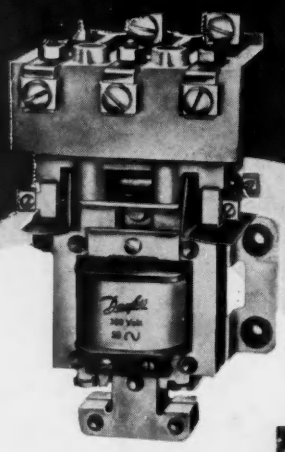
In addition to double and triple pole, 3 phase 4-wire incoming and D.P. outgoing are manufactured.

DISTRIBUTION BOARDS

PARMITER HOPE & SUGDEN LIMITED, MANCHESTER 12

London : 34 Victoria Street, S.W.1. Glasgow : 5 Somerset Place, C.3. Birmingham : 39/41 Carrs Lane, 4

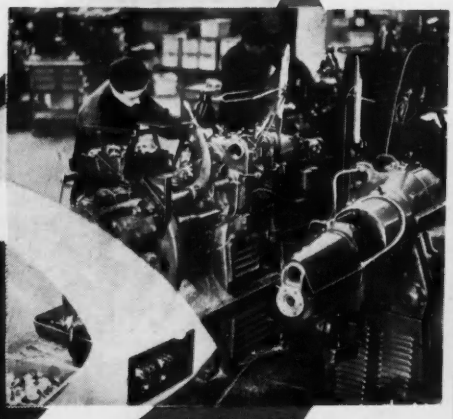
dmPH60



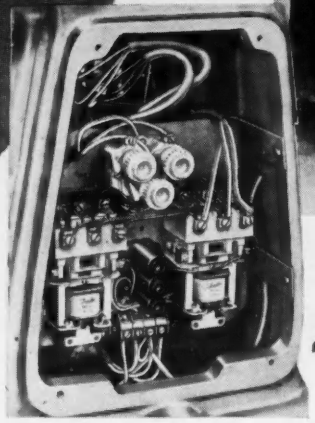
FECT CONTROL
RFECT MACHINE
A MOTOR STARTERS

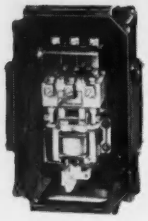
Danf[illegible]

are unsu[illegible]d as to durability of the
swit[illegible]s and long life-time

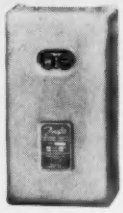


FIT IT-
COVER
FORGET IT





Watertight design



Dustproof design

Also available with thermal overload release

Ask for the Danfoss main catalogue No. 8 which will give you detailed information on every Danfoss gear

Danfoss Manufacturing Company

69, Victoria Street, London, S.W.1. Telephone ABBey 3587